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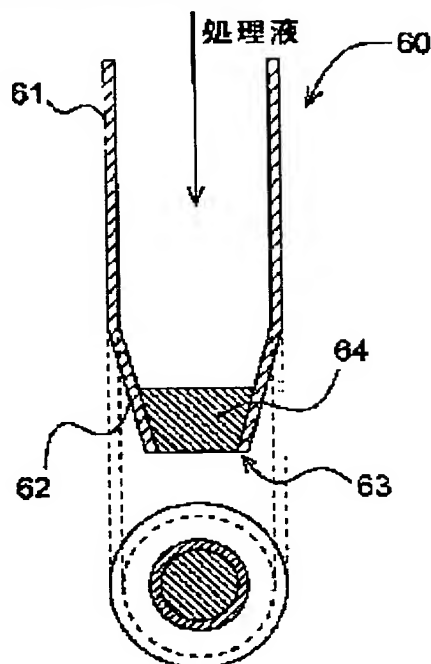
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## (54) TREATING LIQUID DISCHARGE NOZZLE AND LIQUID TREATING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a treating liquid discharge nozzle used for example, for the purpose of treating a glass substrate for a liquid crystal display (LCD) or a substrate such as a semiconductor wafer with a liquid and capable of preventing the liquid sagging and a liquid treating device using the same.

SOLUTION: The discharge nozzle 60 for a rinse liquid, which is one of the treating liquid discharge nozzle, has a liquid feed pipe 61 for feeding the treating liquid and a discharge part 62 communicated with the liquid feed pipe 61 and for discharging the treating liquid. A porous body 64 having liquid holding power is arranged in the discharge part 62 to prevent the liquid sagging.



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**CLAIMS**

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[Claim(s)]

[Claim 1] The processing liquid regurgitation nozzle characterized by arranging the porous body which is opened for free passage by liquid-sending tubing which is the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to a processed object, and sends processing liquid, and said liquid-sending tubing, has the discharge part which carries out the regurgitation of the processing liquid, and has liquid holding power in said discharge part.

[Claim 2] The processing liquid regurgitation nozzle which carries out [ that the porous body which liquid-sending tubing which is the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to a processed object, and sends processing liquid, and said liquid-sending tubing are open for free passage, and the discharge part which carries out the regurgitation of the processing liquid to the lower part is formed, is equipped with the nozzle block arranged to an abbreviation horizontal direction, and has liquid holding power is arranged by abbreviation parallel in the die-length direction in said nozzle block, and ] as the description.

[Claim 3] The processing liquid regurgitation nozzle according to claim 2 characterized by approaching and arranging said porous body in said discharge part.

[Claim 4] A processing liquid regurgitation nozzle given in any 1 term of claim 1 to claim 3 characterized by said porous body being a hollow filament or a hollow filament bundle.

[Claim 5] The processing liquid regurgitation nozzle according to claim 4 characterized by supplying said processing liquid to the cavernous section currently formed in said hollow filament or the hollow filament bundle, and filtering and discharging said processing liquid in the exterior of said hollow filament or a hollow filament bundle.

[Claim 6] A processing liquid regurgitation nozzle given in any 1 term of claim 1 to claim 3 to which said porous body is characterized by being a hollow fiber, a membrane filter, or a ceramic filter.

[Claim 7] The attaching part holding a substrate, and the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to the front face of a substrate, It is a liquid processor possessing the processing liquid regurgitation nozzle migration device in which said processing liquid regurgitation nozzle is moved to the upper part of a substrate from a position in readiness. Said processing liquid regurgitation nozzle The liquid processor characterized by arranging the porous body which is opened for free passage by liquid-sending tubing which sends processing liquid, and the liquid-sending tubing concerned, has the discharge part which carries out the regurgitation of the processing liquid, and has liquid holding power in said discharge part.

[Claim 8] The attaching part holding a substrate, and the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to the front face of a substrate, It is a liquid processor possessing the processing liquid regurgitation nozzle migration device in which said processing liquid regurgitation nozzle is moved to the upper part of a substrate from a position in readiness. Said processing liquid regurgitation nozzle Liquid-sending tubing which sends processing liquid, and said liquid-sending tubing are open for free passage, and the discharge part which carries out the regurgitation of the processing liquid to the lower part is

formed. The liquid processor with which the porous body which is equipped with the nozzle block arranged to an abbreviation horizontal direction, and has liquid holding power is characterized by being arranged in the die-length direction by abbreviation parallel in said nozzle block.

[Claim 9] The liquid processor according to claim 7 or 8 characterized by said porous body being a hollow filament or a hollow filament bundle.

[Claim 10] The liquid processor according to claim 9 characterized by supplying said processing liquid to the cavernous section currently formed in said hollow filament or the hollow filament bundle, and filtering and discharging said processing liquid in the exterior of said hollow filament or a hollow filament bundle.

[Claim 11] The liquid processor according to claim 7 or 8 with which said porous body is characterized by being a hollow fiber, a membrane filter, or a ceramic filter.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the processing liquid regurgitation nozzle and liquid processor which perform liquid processing to for example, the glass substrate for liquid crystal displays (LCD), or a substrate like a semi-conductor wafer.

[0002]

[Description of the Prior Art] For example, in manufacture of a liquid crystal display (LCD), photoresist liquid is applied to the LCD substrate of a glass rectangle, the resist film is formed, the resist film is exposed corresponding to a circuit pattern, and a predetermined pattern is formed by the so-called photolithography technique of carrying out the development of this.

[0003] Formation of such a circuit pattern is performed using resist spreading / development system by which two or more processing units were collected. In such a system, first, after surface treatment and washing processing are performed by UV irradiation if needed to a substrate, brush washing and ultrasonic backwashing by water are given by the washing unit. Then, in order that a substrate may raise the stability of a resist, succeedingly, resist spreading is performed in a resist spreading unit, a predetermined pattern is exposed with an aligner after prebaking, further, a development is carried out, postbake processing is carried out [ hydrophobing processing (adhesion promoter coat) is carried out with an adhesion process unit, ] in a development unit, and a predetermined circuit pattern is formed.

[0004] Here, the development unit is equipped with the cup which collects the developer regurgitation nozzle which carries out the regurgitation of the developer to a substrate, the rinse regurgitation nozzle which carries out the regurgitation of the rinse after a development, the spin chuck for substrate maintenance, the migration device in which a developer regurgitation nozzle and a rinse regurgitation nozzle are moved on a substrate from a position in readiness, respectively, and the processing liquid (a developer, rinse) shaken off to the perimeter of a spin chuck if it explains in more detail about a development unit.

[0005] In case a development is carried out in this development unit, first, a substrate is laid on a spin chuck, a developer regurgitation nozzle is moved on a substrate from a position in readiness, and the liquid peak of the developer is carried out on a substrate. A developer regurgitation nozzle moves to a position in readiness after liquid peak termination. It dries by suspending supply of a rinse discharge and after that and a rinse shaking off a rinse, shaking off a developer, moving a rinse regurgitation nozzle from a position in readiness subsequently to a substrate top, and rotating [ rotate a spin chuck, ] a spin chuck, after predetermined carries out developing time maintenance in this condition. It shakes off and a rinse regurgitation nozzle moves to a position in readiness after desiccation.

[0006]

[Problem(s) to be Soived by the Invention] Although various processing liquid, such as thinner used before and after wash water, a developer, a resist, and resist spreading, was breathed out from the nozzle as mentioned above, the liquid reservoir was conventionally generated near the delivery of a nozzle after the regurgitation, and there was a case where a product was polluted with the liquid lappet of this liquid reservoir.

[0007] For example, when the liquid lappet of resist liquid is generated from the resist regurgitation nozzle which performs resist spreading, the part from which the thickness of the resist film differs in polar zone arises, and problems, like spreading unevenness arises occur, and generating of a defective is caused as a result. And in order to avoid this problem, it becomes complicated [ the structure of a nozzle ], when it carries out to attach a suck back function etc., and the manufacturing cost of the resist regurgitation nozzle itself produces problems, such as becoming high.

[0008] Also in a development, when a developer dripped and falls to the part which separated from the predetermined developer regurgitation location while having stored the developer regurgitation nozzle, development precision may differ partially and deterioration of quality is caused.

[0009] In a rinse process, in case it shakes off, desiccation finishes and a rinse regurgitation nozzle moves to a position in readiness, a possibility that a rinse may carry out a liquid lappet from a rinse regurgitation nozzle is on a substrate. When the liquid lappet of a rinse happens, possibility that marks will be attached on a substrate, or the rinse which dripped and fell will adhere to a substrate transport device, and a rinse will adhere to other substrates becomes large. Thus, if it is sufficient for the remains of a rinse just on a substrate and adhesion etc. is carried out to other substrates, the problem that the yield of a product falls will be produced.

[0010] Processing liquid aims at offering the liquid processor equipped with the processing liquid regurgitation nozzle and such a processing liquid regurgitation nozzle which prevented carrying out a liquid lappet on the substrate at the time of migration, without making this invention in view of this situation, and making structure complicate about the regurgitation nozzle of various processing liquid.

[0011]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, liquid-sending tubing which is the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to a processed object as 1st processing liquid regurgitation nozzle, and sends processing liquid, and said liquid-sending tubing are open for free passage, and, according to this invention, it has the discharge part which carries out the regurgitation of the processing liquid, and processing liquid regurgitation nozzle \*\* characterized by to be arranged the porous body which has liquid holding power in said discharge part is offered.

[0012] Moreover, liquid-sending tubing which according to this invention is the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to a processed object as 2nd processing liquid regurgitation nozzle, and sends processing liquid, Said liquid-sending tubing is open for free passage, the discharge part which carries out the regurgitation of the processing liquid to the lower part is formed, it has the nozzle block arranged to an abbreviation horizontal direction, and processing liquid regurgitation nozzle \*\* characterized by the porous body which has liquid holding power being arranged in the die-length direction by abbreviation parallel at said nozzle block is offered. As for a porous body, about this 2nd processing liquid regurgitation nozzle, approaching and arranging in a discharge part is desirable.

[0013] In the 1st and 2nd processing liquid regurgitation nozzle mentioned above, the processing liquid which remains after the regurgitation of the processing liquid of the specified quantity in a discharge part is held in a discharge part with the suction force using the capillarity which the porous body arranged in the proper place has, without carrying out a liquid lappet. Thereby, generating of the liquid lappet from a nozzle is prevented and improvement in the production yield is achieved.

[0014] When a hollow filament or a hollow filament bundle is used suitably and uses these ingredients as a porous body in these [ 1st ] and the 2nd processing liquid regurgitation nozzle, it is desirable to consider as the configuration which the cavernous section by which processing liquid is formed in the hollow filament or the hollow filament bundle is supplied, and processing liquid is filtered and discharged in the exterior of a hollow filament or a hollow filament bundle, and is further breathed out from a discharge part. Thereby, in addition to the liquid maintenance by the porous body, a porous body functions also as a filter and becomes possible [ removing the unnecessary solid in processing liquid etc. ].

[0015] As other porous bodies, a hollow fiber, a membrane filter, and a ceramic filter can be mentioned, for example. It is desirable that the pore diameter is small, also with such an ingredient, processing liquid will be filtered and any ingredient can prevent adhesion of particle etc. on processed objects, such as a substrate, so that it may have liquid holding power.

[0016] Now, according to this invention, the liquid processor which has the 1st and 2nd processing liquid regurgitation nozzle mentioned above is also offered. Namely, the attaching part holding a substrate and the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to the front face of a substrate, It is a liquid processor possessing the processing liquid regurgitation nozzle migration device in which said processing liquid regurgitation nozzle is moved to the upper part of a substrate from a position in readiness. Said processing liquid regurgitation nozzle Liquid-sending tubing which sends processing liquid, and the liquid-sending tubing concerned are open for free passage, it has the discharge part which carries out the regurgitation of the processing liquid, and liquid processor \*\* characterized by arranging in said discharge part the porous body which has liquid holding power is offered.

[0017] Moreover, the attaching part holding a substrate and the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to the front face of a substrate, It is a liquid processor possessing the processing liquid regurgitation nozzle migration device in which said processing liquid regurgitation nozzle is moved to the upper part of a substrate from a position in readiness. Said processing liquid regurgitation nozzle Liquid-sending tubing which sends processing liquid, and said liquid-sending tubing are open for free passage, and the discharge part which carries out the regurgitation of the processing liquid to the lower part is formed. It has the nozzle block arranged to an abbreviation horizontal direction, and liquid processor \*\* characterized by the porous body which has liquid holding power being arranged in the die-length direction by abbreviation parallel at said nozzle block is offered. The various gestalten of the 1st and 2nd processing liquid regurgitation nozzle mentioned above can be applied to the processing liquid regurgitation nozzle in these liquid processors, and, thereby, the liquid processor which is excellent in processing effectiveness is offered.

[0018]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to an accompanying drawing. The liquid processor which used the processing liquid regurgitation nozzle of this invention and this processing liquid regurgitation nozzle is the top view showing resist spreading and the development system (it is hereafter described as a "processing system".) of the LCD substrate (it is hereafter described as a "substrate".) applied suitably, and drawing 1 decides to outline about this processing system first.

[0019] This processing system equips the cassette station 1 in which the cassette C which holds two or more substrates G is laid, and Substrate G with the processing section 2 equipped with two or more processing units for performing a series of processings including resist spreading and development, and the interface section 3 for delivering Substrate G between aligners (not shown), and the cassette station 1 and the interface section 3 are arranged to the both ends of the processing section 2, respectively.

[0020] The cassette station 1 is equipped with the conveyance device 10 for conveying Substrate G between Cassette C and the processing section 2. And carrying-in appearance of Cassette C is performed at the cassette station 1. Moreover, in the conveyance way 10a top in which the conveyance device 10 was formed along the array direction of a cassette, it has the movable conveyance arm 11 and conveyance of Substrate G is performed by this conveyance arm 11 between Cassette C and the processing section 2.

[0021] The processing section 2 is divided into pre-stage 2a, inside step 2b, and post-stage 2c, it has the conveyance way 12-13-14 in the center, respectively, and each processing unit is arranged in the both sides of these conveyances way. And the junction section 15-16 is formed among these.

[0022] Pre-stage 2a is equipped with the movable main transport device 17 along the conveyance way 12. To the one side of the conveyance way 12 Two washing unit (SCR) 21a and 21b are arranged. To the other side of the conveyance way 12, a UV irradiation unit The

processing block 27 which the processing block 25 which (UV) and the refrigeration unit (COL) repeated to two steps, the processing block 26 which a heat-treatment unit (H.P.) comes to put on two steps, and a refrigeration unit (COL) come to put on two steps is arranged.

[0023] Inside step 2b is equipped with the movable main transport device 18 along the conveyance way 13. Moreover, to the one side of the conveyance way 13 a resist — spreading — processing — a unit — (— CT —) — 22 — and — a substrate — G — a periphery — the section — a resist — removing — a periphery — a resist — removal — a unit — (— ER —) — 23 — one —like — preparing — having — \*\*\*\* — the other side of the conveyance way 13 — A heat-treatment unit The processing block 28 which (H.P.) comes to put on two steps, The processing block 29 which a heat-treatment unit (H.P.) and a cooling processing unit (COL) come to pile up up and down, and the processing block 30 which an adhesion process unit (AD) and a refrigeration unit (COL) come to pile up up and down are arranged.

[0024] Post-stage 2c is equipped with the movable main transport device 19 along the conveyance way 14. Furthermore, to the one side of the conveyance way 14 Three development unit (DEV) 24a, 24b, and 24c are arranged. The processing block 31 which a heat-treatment unit (H.P.) comes to put on two steps and the processing block 32 which a heat-treatment unit (H.P.) and a cooling processing unit (COL) both come to pile up up and down, and 33 are arranged at the other side of the conveyance way 14.

[0025] In addition, the processing section 2 has structure which arranges only washing processing unit 21a, the resist processing unit 22, and a spinner system unit like development unit 24a to one side across a conveyance way, and arranges only heat system processing units, such as a heat-treatment unit and a cooling processing unit, to an another side side.

[0026] Moreover, the drug solution supply unit 34 is arranged and the tooth space 35 for maintaining the main transport device further is provided for the part by the side of spinner system unit arrangement of the junction section 15-16.

[0027] The main transport device 17-18-19 is equipped with the X-axis drive of the 2-way within a horizontal plane, the Y-axis drive, and the vertical Z-axis drive, respectively, is equipped with the rotation drive which rotates focusing on the Z-axis further, and has the arm (not shown) which supports Substrate G, respectively.

[0028] The main transport device 17 has carrying in and taking out of Substrate G to each processing unit of pre-stage 2a, and the function to deliver Substrate G between the junction sections 15 further while delivering Substrate G between the arms 11 of the conveyance device 10. Moreover, the main transport device 18 has carrying in and taking out of Substrate G to each processing unit of inside step 2b, and the function to deliver the substrate G between the junction sections 16 further while delivering Substrate G between the junction sections 15. Furthermore, the main transport device 19 has carrying in and taking out of Substrate G to each processing unit of post-stage 2c, and the function to deliver the substrate G between the interface sections 3 further while delivering Substrate G between the junction sections 16. In addition, the junction section 15-16 functions also as a cooling plate.

[0029] The interface section 3 is equipped with the conveyance device 38 in which carrying-in appearance of the substrate G between the extension 36 which holds a substrate temporarily in case a substrate is delivered between the processing sections 2, two buffer stages 37 which were further established in the both sides and which arrange a buffer cassette, and these and aligners (not shown) is performed. In the conveyance way 38a top in which the conveyance device 38 was formed along the extension 36 and the array direction of the buffer stage 37, it has the movable conveyance arm 39 and conveyance of Substrate G is performed by this conveyance arm 39 between the processing section 2 and an aligner.

[0030] Thus, by collecting each processing unit and unifying, space-saving-izing and the increase in efficiency of processing can be attained.

[0031] Thus, it sets to the constituted processing system. The substrate G in Cassette C is conveyed by the processing section 2. In the processing section 2 First, surface treatment and washing processing are performed in the UV irradiation unit (UV) of the processing block 25 of pre-stage 2a. After being cooled in a cooling processing unit (COL), scrubber washing is performed by washing unit (SCR) 21a and 21b, and after stoving is carried out in one heat-



treatment unit of the processing blocks 26 (H.P.), it is cooled with one refrigeration unit (COL) of the processing blocks 27.

[0032] Then, in order for Substrate G to be conveyed by inside step 2b and to raise fixable [ of a resist ], hydrophobing processing (adhesion promoter coat) is carried out with the adhesion process unit (AD) of the upper case of the processing block 30, a resist is applied in the resist spreading processing unit (CT) 22 after cooling by the cooling processing unit (COL) of the lower berth, and the excessive resist of the periphery of Substrate G is removed in the periphery resist removal unit (ER) 23. Then, prebaking processing is carried out by one of the heat-treatment units in inside step 2b (H.P.), and Substrate G is cooled with the refrigeration unit (COL) of the lower berth of the processing blocks 29 or 30.

[0033] Then, Substrate G is conveyed by the aligner through the interface section 3 by the main transport device 19 from the junction section 16, and a predetermined pattern is exposed there. And after carrying in Substrate G through the interface section 3 again and performing postexposure BEKU processing if needed in one heat-treatment unit of the processing blocks 31-32-33 of post-stage 2c (H.P.), a development is carried out by either development unit (DEV) 24a, 24b and 24c, and a predetermined circuit pattern is formed. It is cooled with one of refrigeration units (COL), and the substrate G by which the development was carried out is held in the predetermined cassette on the cassette station 1 according to the main transport device 19, 18, 17, and the conveyance device 10, after postbake processing is performed in one heat-treatment unit of the post-stage 2c (H.P.).

[0034] Although this invention is used about regurgitation, such as the various processing liquid used in the processing system mentioned above, for example, substrate wash water, (pure water), a resist, a developer, and a rinse, it presupposes a development unit (DEV) hereafter that this invention is explained to an example.

[0035] Drawing 2 is the sectional view of a development unit (DEV), and drawing 3 is the top view of a development unit (DEV). As shown in drawing 2, in development unit (DEV) 24a, 24b, and 24c, Substrate G is held mechanically, for example, it is prepared so that a spin chuck 41 may rotate with the rotation drive 42, and the covering 43 which surrounds the rotation drive 42 is arranged, and two undershirt cups 44-45 are estranged and formed in the periphery enclosure of this covering 43 at this spin-chuck 41 bottom.

[0036] The inner cup 46 for mainly pouring a developer caudad above [ between these two undershirt cups 44-45 ] is formed free [ rise and fall ], and the outer cup 47 for mainly passing a rinse caudad is formed in the outside of the undershirt cup 45 free [ rise and fall ] in one with the inner cup 46. In drawing 2, in left-hand side, the location where the inner cup 46 and the outer cup 47 go up at the time of discharge of a developer is shown, and the location where these descend at the time of discharge of a rinse is shown in right-hand side on it.

[0037] Furthermore, the sink 48 for surrounding these whole development unit is formed, and drain pipe 50b for drain pipe 50a for the exhaust port 49 for exhausting the inside of a unit at the time of rotation desiccation and a developer and a rinse is prepared in the sink 48.

[0038] As shown in drawing 3, the nozzle arm 51 for developers is formed in one outer cup 47 side, and the developer regurgitation nozzle 80 is contained in the nozzle arm 51. The nozzle arm 51 is constituted so that Substrate G may be crossed with the drives 52, such as belt driving, and an orbit may be carried out along with a guide rail 53, and thereby at the time of spreading of a developer, the nozzle arm 51 scans the substrate G which stood the developer still with discharge from the developer supply nozzle.

[0039] The nozzle arm 54 for rinses, such as pure water, is formed in the another side side of the outer cup 47, and the rinse regurgitation nozzle 60 is formed in a part for the point of the nozzle arm 54. The nozzle arm 54 is formed free [ rotation ] by the drive 56 focusing on the pivot 55. Thereby, at the time of the regurgitation of a rinse, the nozzle arm 54 scans Substrate G top for a rinse with discharge from the rinse regurgitation nozzle 60.

[0040] In addition, the lid (not shown) is prepared above the outer cup 47 free [ rise and fall ], and this lid is closed in case it is a rinse. Moreover, notching is formed in the outer cup 47 so that a lid can be closed putting in the rinse regurgitation nozzle 60 in a cup.

[0041] Moreover, the rotation drive 42 made to rotate a spin chuck 41, the drive 52 which drives

the nozzle arm 51 for developers, and the drive 56 made to rotate the nozzle arm 54 for rinses are controlled by the control unit 70 by each to be shown in drawing 4 .

[0042] Next, 1 operation gestalt which applied this invention to the rinse regurgitation nozzle 60 used for development unit (DEV) 24a, 24b, and 24c mentioned above is shown in the sectional view and front view of drawing 5 . The rinse regurgitation nozzle 60 shown in drawing 5 has the structure where the discharge part 62 which extracted the outer diameter to the point of the straight pipe-like liquid-sending tubing 61 gradually was formed, and the porous body 64 which has liquid holding power is arranged in the discharge part 62.

[0043] The bore of the delivery 63 equivalent to opening of a discharge part 62 is the same as the bore of the liquid-sending tubing 61, or although it may be more than it, as shown in drawing 5 , it is desirable at the point that fall is prevented by the wall in a discharge part 62 at the time of the regurgitation of a rinse (processing liquid), and it is not necessary to use other fixed approaches, by extracting the path of a delivery 63 smaller than the bore of the liquid-sending tubing 61. [ of a porous body 64 ]

[0044] Moreover, in drawing 5 , a porous body 64 can also use a film-like thing, although the thing of a truncated-cone form is used. For example, as are shown in drawing 6 (a), and metallic ornaments 66 are arranged inside a discharge part 62 and it is shown in the approach of fixing a filmy body 65 between metallic ornaments 66 and the wall of the liquid-sending tubing 61, and drawing 6 (b) In a discharge part 62, it can constitute so that the liquid-sending tubing 61 can be divided into idiosoma 61a and point 61b in the die-length direction, and the approach of putting a filmy body 65 between idiosoma 61a and point 61b, and fixing in the case of association using connecting fitting 67, etc. can be used.

[0045] As a porous body 64, the high thing of liquid retaining capacity is used by what [ what has liquid holding power ], i.e., the condition that stop liquid sending and a liquid-sending pressure is not applied. For example, what has the capacity which absorbs liquid by capillarity, such as a hollow filament, a hollow filament bundle, a hollow fiber, a membrane filter, and a ceramic filter, and is held is mentioned. Unless the quality of the material is invaded by processing liquid, such as a rinse, there is no limit. Arrangement is easy if a hollow fiber, a membrane filter, and a ceramic filter are used from the configuration with the rinse regurgitation nozzle 60. What is necessary is to use what has a small pore diameter, or just to control the thickness of the ingredient to arrange in the range which does not have forced a facility burden, such as using a large-sized pump etc. for the regurgitation of a rinse, to have bigger liquid holding power, even when which ingredient is used.

[0046] When the porous body 64 was arranged in the discharge part 62 of the rinse regurgitation nozzle 60, and a rinse is sent from the drawing bottom of the liquid-sending tubing 61 using a pump, gas pressure, etc. and is breathed out from a delivery 63, even if a liquid reservoir is formed in about 63 delivery, by the porous body 64, a rinse will be held and a liquid lappet will be avoided. Moreover, when the liquid holding power of a porous body 64 is large, the fall can be prevented even if the force is applied to a liquid reservoir, in case the rinse regurgitation nozzle 60 is moved. Furthermore, there is also an advantage which does not need to attach a liquid lappet prevention device with a complicated suck back device etc., consequently structure can be easy and can produce cheaply in the rinse regurgitation nozzle 60.

[0047] Since a porous body 64 functions also as a filter, it also has the function to remove the solid-state impurity in a rinse, and also plays the role which prevents adhesion of the particle to a substrate, dust, etc. Even if it starts blinding with the solid-state impurity with which a porous body 64 is contained in a rinse, if the liquid-sending tubing 61 or a discharge part 62 is made into dismountable structure, a porous body 64 is begun, exchange and washing of various components are also easy, and if product quality is taken into consideration, the running cost of equipment will not become high.

[0048] In addition, although a porous body 64 also has the function which carries out the regurgitation of the rinse to homogeneity from a porous body 64 since much free passage pores to connote function as a delivery, the gestalt in which it does not have liquid holding power for the purpose of such homogeneity regurgitation, or liquid holding power arranged the small porous body is not included under the category of this invention.

[0049] Next, it explains, referring to the sectional view shown in the perspective view shown in drawing 7 (a), and drawing 7 (b) about 1 operation gestalt which applied this invention to the developer regurgitation nozzle 80. The developer regurgitation nozzle 80 consists of nozzle blocks 82 opened for free passage by the liquid-sending tubing 81 which sends a developer, and the liquid-sending tubing 81. The nozzle block 82 serves as a configuration which has a long cavity in the one direction, and processing liquid (developer) is supplied in this cavity. In addition, the liquid-sending tubing 81 is connected with the air operation bulb (not shown), and it is possible to control supply and a halt of a developer.

[0050] The discharge part 86 which carries out the regurgitation of the developer is formed in the die-length direction of a nozzle block 82 for plurality at intervals of predetermined, and a developer is breathed out from each discharge part 86 by the lower part of a nozzle block 82. Therefore, when a developer is breathed out moving a nozzle block 82 in the direction perpendicular to the die-length direction horizontally, a developer is broadly breathed out by homogeneity and the liquid peak of the developer is carried out on Substrate G.

[0051] Although it is possible about each of a discharge part 86 to arrange a porous body near [ the ] a delivery (for lower opening of a discharge part 86 to be pointed out.) as previously shown in drawing 5, the porous body 83 is arranged by the cavernous lower part of a nozzle block 82 with the developer regurgitation nozzle 80. Thereby, processing liquid is breathed out from a discharge part 86, after being filtered by the porous body 83, when passing a porous body 83.

[0052] With the developer regurgitation nozzle 80, since the porous body 83 is approached and arranged in the discharge part 86, even if a liquid reservoir is formed in a discharge part 86, a liquid lappet is prevented by the liquid holding power of a porous body 83. Moreover, since a developer is filtered by the porous body 83, the solid impurity in a developer is removed and adhesion of particle etc. on a processed object (substrate) is prevented. On the other hand, if it considers as the structure which can open and close a nozzle block 82, exchange is easy even if it is the case where a porous body 83 starts blinding.

[0053] Furthermore, since a developer is breathed out by the almost uniform pressure from the porous body 83 whole by the pressure loss at the time of being filtered by the porous body 83, it also plays the role which carries out the regurgitation of a developer to homogeneity from each discharge part 86 by it. Thereby, on the whole, substrate processing can be carried out now to homogeneity. That is, such a problem is avoided by arrangement of a porous body 83, although it is easy to breathe out many developers from the discharge part near the liquid-sending tubing 81, consequently easy to produce unevenness in a development, when the porous body 83 is not arranged. As a porous body 83, various kinds of ingredients mentioned above can be used.

[0054] Drawing 8 is the explanatory view showing the gestalt of another developer regurgitation nozzle 85 which can be replaced with and used for the developer regurgitation nozzle 80 shown in drawing 7, and the slot 88 where width of face was narrowed is formed in the lower part of a nozzle block 89 used for the developer regurgitation nozzle 85, and it is formed in it in the form where two or more discharge parts 84 project caudad from this slot 88. Arrangement of a porous body 87 can be performed by [ as being able to cover the delivery of restoration or a discharge part 84 ] in a discharge part 84, and can be used like the nozzle block 80 mentioned above so that a slot 88 may be filled up.

[0055] Drawing 9 is the explanatory view showing the gestalt of another nozzle block in the pan which can be replaced with and used for the nozzle block 82 shown in drawing 7, and in this nozzle block 90, the slit-like discharge part 91 is formed in the lower part, and the porous body 92 is arranged so that the delivery of a discharge part 91 may be taken up. Such a configuration can consider that the discharge part of the developer regurgitation nozzle 80-85 mentioned above formed continuously, and can use it like the developer regurgitation nozzle 80-85, and does equivalent effectiveness so.

[0056] Since it is the configuration by which the nozzle block 82-89-90 shown in drawing 7 - drawing 9 has the long configuration in the one direction, it was formed in the lower fang furrow form, or width of face was narrowed, it is easy for the more nearly predetermined depth to fill up with and arrange the large hollow filament and large hollow filament bundle of liquid holding

power, as it meets in the die-length direction of a nozzle block 82-89-90.

[0057] Drawing 10 (a) and (b) are the explanatory views having shown the gestalt which arranged the hollow filament 95 and the hollow filament bundle 96 in the interior using the nozzle block 90. When it considers as such a gestalt, it is easily possible to consider as the configuration which a developer is supplied to the cavernous section 97 currently formed in the hollow filament 95 or the hollow filament bundle 96, and a developer is filtered and discharged in the exterior of a hollow filament 95 or the hollow filament bundle 96, and is further breathed out from each discharge part. In this case, fully taking advantage of the liquid holding power and filtration capacity which a hollow filament 95 or the hollow filament bundle 96 has, it becomes possible to aim at improvement in the processing engine performance.

[0058] In addition, in the gestalt of drawing 10, it can use as a filter and the approach of carrying out the regurgitation from a discharge part 91 can also be used so that a developer may be supplied to the up space of the internal cavity of a nozzle block 90 in which the hollow filament 95 or the hollow filament bundle 96 is not arranged, the wall surface of a hollow filament 95 or the hollow filament bundle 96 may be passed through an internal cavity from the exterior of a hollow filament 95 or the hollow filament bundle 96 and it may be discharged outside again.

[0059] As mentioned above, although the gestalt of operation of this invention has been explained, this invention is not limited to the gestalt of the above-mentioned implementation. For example, although the above-mentioned operation gestalt explained the case where the liquid processor which used the processing liquid regurgitation nozzle of this invention and this for resist spreading and a development system was applied, it does not restrict to this. Moreover, although the LCD substrate has been explained as a processed substrate, it is possible to use about other substrates, such as a semi-conductor wafer and CD substrate.

[0060]

[Effect of the Invention] According to this invention an above-mentioned passage, after regurgitation termination, since the porous body which has liquid holding power near the discharge part of various kinds of nozzles which carry out the regurgitation of the processing liquid is arranged, even if it is the case where a liquid reservoir is formed in a delivery, liquid is attracted by the porous body and a liquid lappet is prevented by it. The remarkable effectiveness that improvement in the yield is achieved is done so, without polluting by this the device member to which migration etc. carries out a processing substrate and a substrate. Moreover, from a viewpoint of prevention of a liquid lappet, there is also an advantage which becomes possible [ it not being necessary to attach complicated devices, such as a suck back function, and the design degree of freedom of structure or a configuration becoming large, and also holding down a manufacturing cost ]. Furthermore, according to this invention, since a porous body also has the filtration function of processing liquid, the various solid impurities in processing liquid are removed. Thereby, adhesion of particle etc. in a processing substrate is prevented and improvement in the quality of a product (processing substrate) and improvement in the yield are achieved. In addition, this invention does various effectiveness so from processing liquid being breathed out by homogeneity from a porous body by arranging a porous body -- homogeneous improvement in liquid processing, as a result upgrading of a product are planned.

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[Translation done.]

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**TECHNICAL FIELD**

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[Field of the Invention] This invention relates to the processing liquid regurgitation nozzle and liquid processor which perform liquid processing to for example, the glass substrate for liquid crystal displays (LCD), or a substrate like a semi-conductor wafer.

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PRIOR ART

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[Description of the Prior Art] For example, in manufacture of a liquid crystal display (LCD), photoresist liquid is applied to the LCD substrate of a glass rectangle, the resist film is formed, the resist film is exposed corresponding to a circuit pattern, and a predetermined pattern is formed by the so-called photolithography technique of carrying out the development of this.

[0003] Formation of such a circuit pattern is performed using resist spreading / development system by which two or more processing units were collected. In such a system, first, after surface treatment and washing processing are performed by UV irradiation if needed to a substrate, brush washing and ultrasonic backwashing by water are given by the washing unit. Then, in order that a substrate may raise the stability of a resist, succeeding, resist spreading is performed in a resist spreading unit, a predetermined pattern is exposed with an aligner after prebaking, further, a development is carried out, postbake processing is carried out [ hydrophobing processing (adhesion promoter coat) is carried out with an adhesion process unit, ] in a development unit, and a predetermined circuit pattern is formed.

[0004] Here, the development unit is equipped with the cup which collects the developer regurgitation nozzle which carries out the regurgitation of the developer to a substrate, the rinse regurgitation nozzle which carries out the regurgitation of the rinse after a development, the spin chuck for substrate maintenance, the migration device in which a developer regurgitation nozzle and a rinse regurgitation nozzle are moved on a substrate from a position in readiness, respectively, and the processing liquid (a developer, rinse) shaken off to the perimeter of a spin chuck if it explains in more detail about a development unit.

[0005] In case a development is carried out in this development unit, first, a substrate is laid on a spin chuck, a developer regurgitation nozzle is moved on a substrate from a position in readiness, and the liquid peak of the developer is carried out on a substrate. A developer regurgitation nozzle moves to a position in readiness after liquid peak termination. It dries by suspending supply of a rinse discharge and after that and a rinse shaking off a rinse, shaking off a developer, moving a rinse regurgitation nozzle from a position in readiness subsequently to a substrate top, and rotating [ rotate a spin chuck, ] a spin chuck, after predetermined carries out developing time maintenance in this condition. It shakes off and a rinse regurgitation nozzle moves to a position in readiness after desiccation.

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EFFECT OF THE INVENTION

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[Effect of the Invention] According to this invention an above-mentioned passage, after regurgitation termination, since the porous body which has liquid holding power near the discharge part of various kinds of nozzles which carry out the regurgitation of the processing liquid is arranged, even if it is the case where a liquid reservoir is formed in a delivery, liquid is attracted by the porous body and a liquid lappet is prevented by it. The remarkable effectiveness that improvement in the yield is achieved is done so, without polluting by this the device member to which migration etc. carries out a processing substrate and a substrate. Moreover, from a viewpoint of prevention of a liquid lappet, there is also an advantage which becomes possible [ it not being necessary to attach complicated devices, such as a suck back function, and the design degree of freedom of structure or a configuration becoming large, and also holding down a manufacturing cost ]. Furthermore, according to this invention, since a porous body also has the filtration function of processing liquid, the various solid impurities in processing liquid are removed. Thereby, adhesion of particle etc. in a processing substrate is prevented and improvement in the quality of a product (processing substrate) and improvement in the yield are achieved. In addition, this invention does various effectiveness so from processing liquid being breathed out by homogeneity from a porous body by arranging a porous body — homogeneous improvement in liquid processing, as a result upgrading of a product are planned.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] Although various processing liquid, such as thinner used before and after wash water, a developer, a resist, and resist spreading, was breathed out from the nozzle as mentioned above, the liquid reservoir was conventionally generated near the delivery of a nozzle after the regurgitation, and there was a case where a product was polluted with the liquid lappet of this liquid reservoir.

[0007] For example, when the liquid lappet of resist liquid is generated from the resist regurgitation nozzle which performs resist spreading, the part from which the thickness of the resist film differs in polar zone arises, and problems, like spreading unevenness arises occur, and generating of a defective is caused as a result. And in order to avoid this problem, it becomes complicated [ the structure of a nozzle ], when it carries out to attach a suck back function etc., and the manufacturing cost of the resist regurgitation nozzle itself produces problems, such as becoming high.

[0008] Also in a development, when a developer dripped and falls to the part which separated from the predetermined developer regurgitation location while having stored the developer regurgitation nozzle, development precision may differ partially and deterioration of quality is caused.

[0009] In a rinse process, in case it shakes off, desiccation finishes and a rinse regurgitation nozzle moves to a position in readiness, a possibility that a rinse may carry out a liquid lappet from a rinse regurgitation nozzle is on a substrate. When the liquid lappet of a rinse happens, possibility that marks will be attached on a substrate, or the rinse which dripped and fell will adhere to a substrate transport device, and a rinse will adhere to other substrates becomes large. Thus, if it is sufficient for the remains of a rinse just on a substrate and adhesion etc. is carried out to other substrates, the problem that the yield of a product falls will be produced.

[0010] Processing liquid aims at offering the liquid processor equipped with the processing liquid regurgitation nozzle and such a processing liquid regurgitation nozzle which prevented carrying out a liquid lappet on the substrate at the time of migration, without making this invention in view of this situation, and making structure complicate about the regurgitation nozzle of various processing liquid.

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[Translation done.]



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MEANS

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[Means for Solving the Problem] In order to solve the above-mentioned technical problem, liquid-sending tubing which is the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to a processed object as 1st processing liquid regurgitation nozzle, and sends processing liquid, and said liquid-sending tubing are open for free passage, and, according to this invention, it has the discharge part which carries out the regurgitation of the processing liquid, and processing liquid regurgitation nozzle \*\* characterized by to be arranged the porous body which has liquid holding power in said discharge part is offered.

[0012] Moreover, liquid-sending tubing which according to this invention is the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to a processed object as 2nd processing liquid regurgitation nozzle, and sends processing liquid, Said liquid-sending tubing is open for free passage, the discharge part which carries out the regurgitation of the processing liquid to the lower part is formed, it has the nozzle block arranged to an abbreviation horizontal direction, and processing liquid regurgitation nozzle \*\* characterized by the porous body which has liquid holding power being arranged in the die-length direction by abbreviation parallel at said nozzle block is offered. As for a porous body, about this 2nd processing liquid regurgitation nozzle, approaching and arranging in a discharge part is desirable.

[0013] In the 1st and 2nd processing liquid regurgitation nozzle mentioned above, the processing liquid which remains after the regurgitation of the processing liquid of the specified quantity in a discharge part is held in a discharge part with the suction force using the capillarity which the porous body arranged in the proper place has, without carrying out a liquid lappet. Thereby, generating of the liquid lappet from a nozzle is prevented and improvement in the production yield is achieved.

[0014] When a hollow filament or a hollow filament bundle is used suitably and uses these ingredients as a porous body in these [ 1st ] and the 2nd processing liquid regurgitation nozzle, it is desirable to consider as the configuration which the cavernous section by which processing liquid is formed in the hollow filament or the hollow filament bundle is supplied, and processing liquid is filtered and discharged in the exterior of a hollow filament or a hollow filament bundle, and is further breathed out from a discharge part. Thereby, in addition to the liquid maintenance by the porous body, a porous body functions also as a filter and becomes possible [ removing the unnecessary solid in processing liquid etc. ].

[0015] As other porous bodies, a hollow fiber, a membrane filter, and a ceramic filter can be mentioned, for example. It is desirable that the pore diameter is small, also with such an ingredient, processing liquid will be filtered and any ingredient can prevent adhesion of particle etc. on processed objects, such as a substrate, so that it may have liquid holding power.

[0016] Now, according to this invention, the liquid processor which has the 1st and 2nd processing liquid regurgitation nozzle mentioned above is also offered. Namely, the attaching part holding a substrate and the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to the front face of a substrate, It is a liquid processor possessing the processing liquid regurgitation nozzle migration device in which said processing liquid regurgitation nozzle is moved to the upper part of a substrate from a position in readiness. Said processing liquid regurgitation nozzle Liquid-sending tubing which sends processing liquid,

and the liquid-sending tubing concerned are open for free passage, it has the discharge part which carries out the regurgitation of the processing liquid, and liquid processor \*\* characterized by arranging in said discharge part the porous body which has liquid holding power is offered.

[0017] Moreover, the attaching part holding a substrate and the processing liquid regurgitation nozzle which carries out the regurgitation of the processing liquid to the front face of a substrate, It is a liquid processor possessing the processing liquid regurgitation nozzle migration device in which said processing liquid regurgitation nozzle is moved to the upper part of a substrate from a position in readiness. Said processing liquid regurgitation nozzle Liquid-sending tubing which sends processing liquid, and said liquid-sending tubing are open for free passage, and the discharge part which carries out the regurgitation of the processing liquid to the lower part is formed. It has the nozzle block arranged to an abbreviation horizontal direction, and liquid processor \*\* characterized by the porous body which has liquid holding power being arranged in the die-length direction by abbreviation parallel at said nozzle block is offered. The various gestalten of the 1st and 2nd processing liquid regurgitation nozzle mentioned above can be applied to the processing liquid regurgitation nozzle in these liquid processors, and, thereby, the liquid processor which is excellent in processing effectiveness is offered.

[0018]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to an accompanying drawing. The liquid processor which used the processing liquid regurgitation nozzle of this invention and this processing liquid regurgitation nozzle is the top view showing resist spreading and the development system (it is hereafter described as a "processing system".) of the LCD substrate (it is hereafter described as a "substrate".) applied suitably, and drawing 1 decides to outline about this processing system first.

[0019] This processing system equips the cassette station 1 in which the cassette C which holds two or more substrates G is laid, and Substrate G with the processing section 2 equipped with two or more processing units for performing a series of processings including resist spreading and development, and the interface section 3 for delivering Substrate G between aligners (not shown), and the cassette station 1 and the interface section 3 are arranged to the both ends of the processing section 2, respectively.

[0020] The cassette station 1 is equipped with the conveyance device 10 for conveying Substrate G between Cassette C and the processing section 2. And carrying-in appearance of Cassette C is performed at the cassette station 1. Moreover, in the conveyance way 10a top in which the conveyance device 10 was formed along the array direction of a cassette, it has the movable conveyance arm 11 and conveyance of Substrate G is performed by this conveyance arm 11 between Cassette C and the processing section 2.

[0021] The processing section 2 is divided into pre-stage 2a, inside step 2b, and post-stage 2c, it has the conveyance way 12-13-14 in the center, respectively, and each processing unit is arranged in the both sides of these conveyances way. And the junction section 15-16 is formed among these.

[0022] Pre-stage 2a is equipped with the movable main transport device 17 along the conveyance way 12. To the one side of the conveyance way 12 Two washing unit (SCR) 21a and 21b are arranged. To the other side of the conveyance way 12, a UV irradiation unit The processing block 27 which the processing block 25 which (UV) and the refrigeration unit (COL) repeated to two steps, the processing block 26 which a heat-treatment unit (H.P.) comes to put on two steps, and a refrigeration unit (COL) come to put on two steps is arranged.

[0023] Inside step 2b is equipped with the movable main transport device 18 along the conveyance way 13. Moreover, to the one side of the conveyance way 13 a resist — spreading — processing — a unit — (— CT —) — 22 — and — a substrate — G — a periphery — the section — a resist — removing — a periphery — a resist — removal — a unit — (— ER —) — 23 — one — like — preparing — having — \*\*\*\* — the other side of the conveyance way 13 — A heat-treatment unit The processing block 28 which (H.P.) comes to put on two steps, The processing block 29 which a heat-treatment unit (H.P.) and a cooling processing unit (COL) come to pile up up and down, and the processing block 30 which an adhesion process unit (AD)

and a refrigeration unit (COL) come to pile up up and down are arranged.

[0024] Post-stage 2c is equipped with the movable main transport device 19 along the conveyance way 14. Furthermore, to the one side of the conveyance way 14 Three development unit (DEV) 24a, 24b, and 24c are arranged. The processing block 31 which a heat-treatment unit (H.P.) comes to put on two steps and the processing block 32 which a heat-treatment unit (H.P.) and a cooling processing unit (COL) both come to pile up up and down, and 33 are arranged at the other side of the conveyance way 14.

[0025] In addition, the processing section 2 has structure which arranges only washing processing unit 21a, the resist processing unit 22, and a spinner system unit like development unit 24a to one side across a conveyance way, and arranges only heat system processing units, such as a heat-treatment unit and a cooling processing unit, to an another side side.

[0026] Moreover, the drug solution supply unit 34 is arranged and the tooth space 35 for maintaining the main transport device further is provided for the part by the side of spinner system unit arrangement of the junction section 15-16.

[0027] The main transport device 17-18-19 is equipped with the X-axis drive of the 2-way within a horizontal plane, the Y-axis drive, and the vertical Z-axis drive, respectively, is equipped with the rotation drive which rotates focusing on the Z-axis further, and has the arm (not shown) which supports Substrate G, respectively.

[0028] The main transport device 17 has carrying in and taking out of Substrate G to each processing unit of pre-stage 2a, and the function to deliver Substrate G between the junction sections 15 further while delivering Substrate G between the arms 11 of the conveyance device 10. Moreover, the main transport device 18 has carrying in and taking out of Substrate G to each processing unit of inside step 2b, and the function to deliver the substrate G between the junction sections 16 further while delivering Substrate G between the junction sections 15. Furthermore, the main transport device 19 has carrying in and taking out of Substrate G to each processing unit of post-stage 2c, and the function to deliver the substrate G between the interface sections 3 further while delivering Substrate G between the junction sections 16. In addition, the junction section 15-16 functions also as a cooling plate.

[0029] The interface section 3 is equipped with the conveyance device 38 in which carrying-in appearance of the substrate G between the extension 36 which holds a substrate temporarily in case a substrate is delivered between the processing sections 2, two buffer stages 37 which were further established in the both sides and which arrange a buffer cassette, and these and aligners (not shown) is performed. In the conveyance way 38a top in which the conveyance device 38 was formed along the extension 36 and the array direction of the buffer stage 37, it has the movable conveyance arm 39 and conveyance of Substrate G is performed by this conveyance arm 39 between the processing section 2 and an aligner.

[0030] Thus, by collecting each processing unit and unifying, space-saving-izing and the increase in efficiency of processing can be attained.

[0031] Thus, it sets to the constituted processing system. The substrate G in Cassette C is conveyed by the processing section 2. In the processing section 2 First, surface treatment and washing processing are performed in the UV irradiation unit (UV) of the processing block 25 of pre-stage 2a. After being cooled in a cooling processing unit (COL), scrubber washing is performed by washing unit (SCR) 21a and 21b, and after stoving is carried out in one heat-treatment unit of the processing blocks 26 (H.P.), it is cooled with one refrigeration unit (COL) of the processing blocks 27.

[0032] Then, in order for Substrate G to be conveyed by inside step 2b and to raise fixable [ of a resist ], hydrophobing processing (adhesion promoter coat) is carried out with the adhesion process unit (AD) of the upper case of the processing block 30, a resist is applied in the resist spreading processing unit (CT) 22 after cooling by the cooling processing unit (COL) of the lower berth, and the excessive resist of the periphery of Substrate G is removed in the periphery resist removal unit (ER) 23. Then, prebaking processing is carried out by one of the heat-treatment units in inside step 2b (H.P.), and Substrate G is cooled with the refrigeration unit (COL) of the lower berth of the processing blocks 29 or 30.

[0033] Then, Substrate G is conveyed by the aligner through the interface section 3 by the main

transport device 19 from the junction section 16, and a predetermined pattern is exposed there. And after carrying in Substrate G through the interface section 3 again and performing postexposure BEKU processing if needed in one heat-treatment unit of the processing blocks 31-32-33 of post-stage 2c (H.P.), a development is carried out by either development unit (DEV) 24a, 24b and 24c, and a predetermined circuit pattern is formed. It is cooled with one of refrigeration units (COL), and the substrate G by which the development was carried out is held in the predetermined cassette on the cassette station 1 according to the main transport device 19, 18, 17, and the conveyance device 10, after postbake processing is performed in one heat-treatment unit of the post-stage 2c (H.P.).

[0034] Although this invention is used about regurgitation, such as the various processing liquid used in the processing system mentioned above, for example, substrate wash water, (pure water), a resist, a developer, and a rinse, it presupposes a development unit (DEV) hereafter that this invention is explained to an example.

[0035] Drawing 2 is the sectional view of a development unit (DEV), and drawing 3 is the top view of a development unit (DEV). As shown in drawing 2, in development unit (DEV) 24a, 24b, and 24c, Substrate G is held mechanically, for example, it is prepared so that a spin chuck 41 may rotate with the rotation drive 42, and the covering 43 which surrounds the rotation drive 42 is arranged, and two undershirt cups 44-45 are estranged and formed in the periphery enclosure of this covering 43 at this spin-chuck 41 bottom.

[0036] The inner cup 46 for mainly pouring a developer caudad above [ between these two undershirt cups 44-45 ] is formed free [ rise and fall ], and the outer cup 47 for mainly passing a rinse caudad is formed in the outside of the undershirt cup 45 free [ rise and fall ] in one with the inner cup 46. In drawing 2, in left-hand side, the location where the inner cup 46 and the outer cup 47 go up at the time of discharge of a developer is shown, and the location where these descend at the time of discharge of a rinse is shown in right-hand side on it.

[0037] Furthermore, the sink 48 for surrounding these whole development unit is formed, and drain pipe 50b for drain pipe 50a for the exhaust port 49 for exhausting the inside of a unit at the time of rotation desiccation and a developer and a rinse is prepared in the sink 48.

[0038] As shown in drawing 3, the nozzle arm 51 for developers is formed in one outer cup 47 side, and the developer regurgitation nozzle 80 is contained in the nozzle arm 51. The nozzle arm 51 is constituted so that Substrate G may be crossed with the drives 52, such as belt driving, and an orbit may be carried out along with a guide rail 53, and thereby at the time of spreading of a developer, the nozzle arm 51 scans the substrate G which stood the developer still with discharge from the developer supply nozzle.

[0039] The nozzle arm 54 for rinses, such as pure water, is formed in the another side side of the outer cup 47, and the rinse regurgitation nozzle 60 is formed in a part for the point of the nozzle arm 54. The nozzle arm 54 is formed free [ rotation ] by the drive 56 focusing on the pivot 55. Thereby, at the time of the regurgitation of a rinse, the nozzle arm 54 scans Substrate G top for a rinse with discharge from the rinse regurgitation nozzle 60.

[0040] In addition, the lid (not shown) is prepared above the outer cup 47 free [ rise and fall ], and this lid is closed in case it is a rinse. Moreover, notching is formed in the outer cup 47 so that a lid can be closed putting in the rinse regurgitation nozzle 60 in a cup.

[0041] Moreover, the rotation drive 42 made to rotate a spin chuck 41, the drive 52 which drives the nozzle arm 51 for developers, and the drive 56 made to rotate the nozzle arm 54 for rinses are controlled by the control unit 70 by each to be shown in drawing 4.

[0042] Next, 1 operation gestalt which applied this invention to the rinse regurgitation nozzle 60 used for development unit (DEV) 24a, 24b, and 24c mentioned above is shown in the sectional view and front view of drawing 5. The rinse regurgitation nozzle 60 shown in drawing 5 has the structure where the discharge part 62 which extracted the outer diameter to the point of the straight pipe-like liquid-sending tubing 61 gradually was formed, and the porous body 64 which has liquid holding power is arranged in the discharge part 62.

[0043] The bore of the delivery 63 equivalent to opening of a discharge part 62 is the same as the bore of the liquid-sending tubing 61, or although it may be more than it, as shown in drawing 5, it is desirable at the point that fall is prevented by the wall in a discharge part 62 at the time

of the regurgitation of a rinse (processing liquid), and it is not necessary to use other fixed approaches, by extracting the path of a delivery 63 smaller than the bore of the liquid-sending tubing 61. [ of a porous body 64 ]

[0044] Moreover, in drawing 5 , a porous body 64 can also use a film-like thing, although the thing of a truncated-cone form is used. For example, as are shown in drawing 6 (a), and metallic ornaments 66 are arranged inside a discharge part 62 and it is shown in the approach of fixing a filmy body 65 between metallic ornaments 66 and the wall of the liquid-sending tubing 61, and drawing 6 (b) In a discharge part 62, it can constitute so that the liquid-sending tubing 61 can be divided into idiosoma 61a and point 61b in the die-length direction, and the approach of putting a filmy body 65 between idiosoma 61a and point 61b, and fixing in the case of association using connecting fitting 67, etc. can be used.

[0045] As a porous body 64, the high thing of liquid retaining capacity is used by what [ what has liquid holding power ], i.e., the condition that stop liquid sending and a liquid-sending pressure is not applied. For example, what has the capacity which absorbs liquid by capillarity, such as a hollow filament, a hollow filament bundle, a hollow fiber, a membrane filter, and a ceramic filter, and is held is mentioned. Unless the quality of the material is invaded by processing liquid, such as a rinse, there is no limit. Arrangement is easy if a hollow fiber, a membrane filter, and a ceramic filter are used from the configuration with the rinse regurgitation nozzle 60. What is necessary is to use what has a small pore diameter, or just to control the thickness of the ingredient to arrange in the range which does not have forced a facility burden, such as using a large-sized pump etc. for the regurgitation of a rinse, to have bigger liquid holding power, even when which ingredient is used.

[0046] When the porous body 64 was arranged in the discharge part 62 of the rinse regurgitation nozzle 60, and a rinse is sent from the drawing bottom of the liquid-sending tubing 61 using a pump, gas pressure, etc. and is breathed out from a delivery 63, even if a liquid reservoir is formed in about 63 delivery, by the porous body 64, a rinse will be held and a liquid lappet will be avoided. Moreover, when the liquid holding power of a porous body 64 is large, the fall can be prevented even if the force is applied to a liquid reservoir, in case the rinse regurgitation nozzle 60 is moved. Furthermore, there is also an advantage which does not need to attach a liquid lappet prevention device with a complicated suck back device etc., consequently structure can be easy and can produce cheaply in the rinse regurgitation nozzle 60.

[0047] Since a porous body 64 functions also as a filter, it also has the function to remove the solid-state impurity in a rinse, and also plays the role which prevents adhesion of the particle to a substrate, dust, etc. Even if it starts blinding with the solid-state impurity with which a porous body 64 is contained in a rinse, if the liquid-sending tubing 61 or a discharge part 62 is made into dismountable structure, a porous body 64 is begun, exchange and washing of various components are also easy, and if product quality is taken into consideration, the running cost of equipment will not become high.

[0048] In addition, although a porous body 64 also has the function which carries out the regurgitation of the rinse to homogeneity from a porous body 64 since much free passage pores to connote function as a delivery, the gestalt in which it does not have liquid holding power for the purpose of such homogeneity regurgitation, or liquid holding power arranged the small porous body is not included under the category of this invention.

[0049] Next, it explains, referring to the sectional view shown in the perspective view shown in drawing 7 (a), and drawing 7 (b) about 1 operation gestalt which applied this invention to the developer regurgitation nozzle 80. The developer regurgitation nozzle 80 consists of nozzle blocks 82 opened for free passage by the liquid-sending tubing 81 which sends a developer, and the liquid-sending tubing 81. The nozzle block 82 serves as a configuration which has a long cavity in the one direction, and processing liquid (developer) is supplied in this cavity. In addition, the liquid-sending tubing 81 is connected with the air operation bulb (not shown), and it is possible to control supply and a halt of a developer.

[0050] The discharge part 86 which carries out the regurgitation of the developer is formed in the die-length direction of a nozzle block 82 for plurality at intervals of predetermined, and a developer is breathed out from each discharge part 86 by the lower part of a nozzle block 82.

Therefore, when a developer is breathed out moving a nozzle block 82 in the direction perpendicular to the die-length direction horizontally, a developer is broadly breathed out by homogeneity and the liquid peak of the developer is carried out on Substrate G.

[0051] Although it is possible about each of a discharge part 86 to arrange a porous body near [ the ] a delivery (for lower opening of a discharge part 86 to be pointed out.) as previously shown in drawing 5 , the porous body 83 is arranged by the cavernous lower part of a nozzle block 82 with the developer regurgitation nozzle 80. Thereby, processing liquid is breathed out from a discharge part 86, after being filtered by the porous body 83, when passing a porous body 83.

[0052] With the developer regurgitation nozzle 80, since the porous body 83 is approached and arranged in the discharge part 86, even if a liquid reservoir is formed in a discharge part 86, a liquid lappet is prevented by the liquid holding power of a porous body 83. Moreover, since a developer is filtered by the porous body 83, the solid impurity in a developer is removed and adhesion of particle etc. on a processed object (substrate) is prevented. On the other hand, if it considers as the structure which can open and close a nozzle block 82, exchange is easy even if it is the case where a porous body 83 starts blinding.

[0053] Furthermore, since a developer is breathed out by the almost uniform pressure from the porous body 83 whole by the pressure loss at the time of being filtered by the porous body 83, it also plays the role which carries out the regurgitation of a developer to homogeneity from each discharge part 86 by it. Thereby, on the whole, substrate processing can be carried out now to homogeneity. That is, such a problem is avoided by arrangement of a porous body 83, although it is easy to breathe out many developers from the discharge part near the liquid-sending tubing 81, consequently easy to produce unevenness in a development, when the porous body 83 is not arranged. As a porous body 83, various kinds of ingredients mentioned above can be used.

[0054] Drawing 8 is the explanatory view showing the gestalt of another developer regurgitation nozzle 85 which can be replaced with and used for the developer regurgitation nozzle 80 shown in drawing 7 , and the slot 88 where width of face was narrowed is formed in the lower part of a nozzle block 89 used for the developer regurgitation nozzle 85, and it is formed in it in the form where two or more discharge parts 84 project caudad from this slot 88. Arrangement of a porous body 87 can be performed by [ as being able to cover the delivery of restoration or a discharge part 84 ] in a discharge part 84, and can be used like the nozzle block 80 mentioned above so that a slot 88 may be filled up.

[0055] Drawing 9 is the explanatory view showing the gestalt of another nozzle block in the pan which can be replaced with and used for the nozzle block 82 shown in drawing 7 , and in this nozzle block 90, the slit-like discharge part 91 is formed in the lower part, and the porous body 92 is arranged so that the delivery of a discharge part 91 may be taken up. Such a configuration can consider that the discharge part of the developer regurgitation nozzle 80-85 mentioned above formed continuously, and can use it like the developer regurgitation nozzle 80-85, and does equivalent effectiveness so.

[0056] Since it is the configuration by which the nozzle block 82-89-90 shown in drawing 7 - drawing 9 has the long configuration in the one direction, it was formed in the lower fang furrow form, or width of face was narrowed, it is easy for the more nearly predetermined depth to fill up with and arrange the large hollow filament and large hollow filament bundle of liquid holding power, as it meets in the die-length direction of a nozzle block 82-89-90.

[0057] Drawing 10 (a) and (b) are the explanatory views having shown the gestalt which arranged the hollow filament 95 and the hollow filament bundle 96 in the interior using the nozzle block 90. When it considers as such a gestalt, it is easily possible to consider as the configuration which a developer is supplied to the cavernous section 97 currently formed in the hollow filament 95 or the hollow filament bundle 96, and a developer is filtered and discharged in the exterior of a hollow filament 95 or the hollow filament bundle 96, and is further breathed out from each discharge part. In this case, fully taking advantage of the liquid holding power and filtration capacity which a hollow filament 95 or the hollow filament bundle 96 has, it becomes possible to aim at improvement in the processing engine performance.

[0058] In addition, in the gestalt of drawing 10 , it can use as a filter and the approach of

carrying out the regurgitation from a discharge part 91 can also be used so that a developer may be supplied to the up space of the internal cavity of a nozzle block 90 in which the hollow filament 95 or the hollow filament bundle 96 is not arranged, the wall surface of a hollow filament 95 or the hollow filament bundle 96 may be passed through an internal cavity from the exterior of a hollow filament 95 or the hollow filament bundle 96 and it may be discharged outside again.

[0059] As mentioned above, although the gestalt of operation of this invention has been explained, this invention is not limited to the gestalt of the above-mentioned implementation. For example, although the above-mentioned operation gestalt explained the case where the liquid processor which used the processing liquid regurgitation nozzle of this invention and this for resist spreading and a development system was applied, it does not restrict to this. Moreover, although the LCD substrate has been explained as a processed substrate, it is possible to use about other substrates, such as a semi-conductor wafer and CD substrate.

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[Translation done.]



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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] The top view showing resist spreading / development system by which the heat treatment equipment set as the object of this invention is applied.

[Drawing 2] The sectional view of a development unit (DEV).

[Drawing 3] The top view of a development unit (DEV).

[Drawing 4] The block diagram showing the control system in the development unit shown in drawing 2 and drawing 3 .

[Drawing 5] The sectional view and front view showing 1 operation gestalt of the processing liquid regurgitation nozzle (rinse regurgitation nozzle) which applied this invention.

[Drawing 6] The sectional view showing another arrangement gestalt of the porous body in a processing liquid regurgitation nozzle given in drawing 5 .

[Drawing 7] The perspective view and sectional view showing another operation gestalt of the processing liquid regurgitation nozzle (developer regurgitation nozzle) which applied this invention.

[Drawing 8] The perspective view showing still more nearly another operation gestalt of the processing liquid regurgitation nozzle (developer regurgitation nozzle) which applied this invention.

[Drawing 9] The explanatory view showing another operation gestalt of the nozzle block used for the processing liquid regurgitation nozzle (developer regurgitation nozzle) which applied this invention.

[Drawing 10] The explanatory view showing still more nearly another operation gestalt of the nozzle block used for the processing liquid regurgitation nozzle (developer regurgitation nozzle) which applied this invention.

### [Description of Notations]

24a, 24b, 24c; development unit

41; spin chuck

42; rotation drive

46; inner cup

47; outer cup

60; rinse regurgitation nozzle (processing liquid regurgitation nozzle)

61; liquid-sending tubing

62; discharge part

63; delivery

64; porous body

80 85; developer regurgitation nozzle

81; liquid-sending tubing

82, 89, 90; nozzle block

83, 87, 92; porous body

86; discharge part

88; slot

95; hollow filament



96; hollow filament bundle

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[Translation done.]

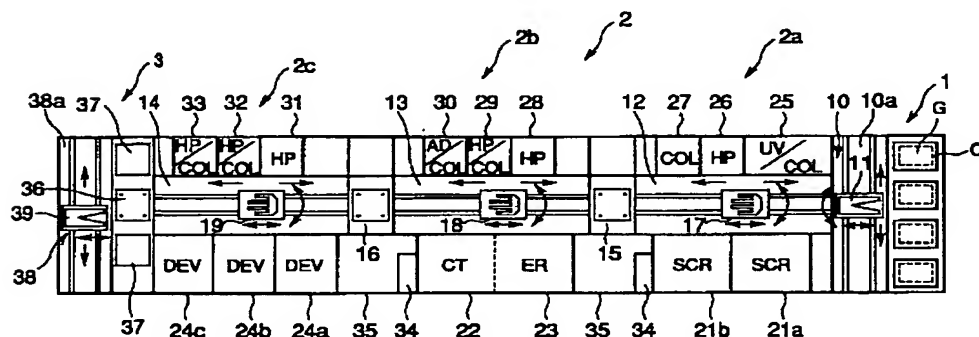
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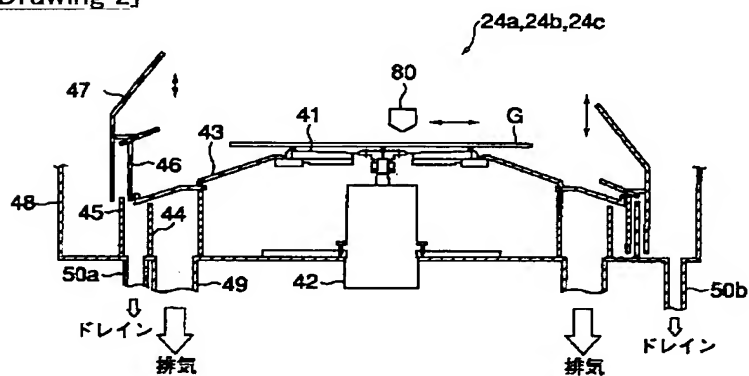
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## DRAWINGS

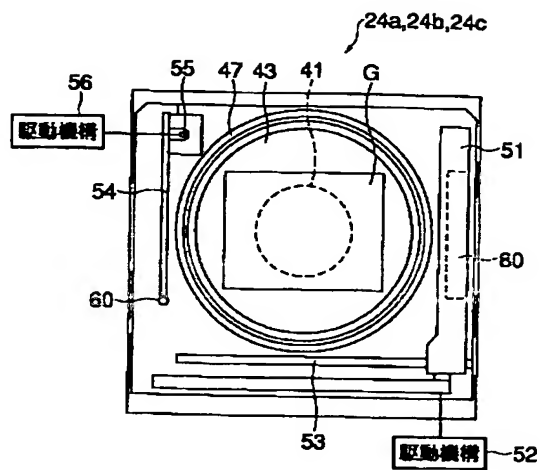
[Drawing 1]



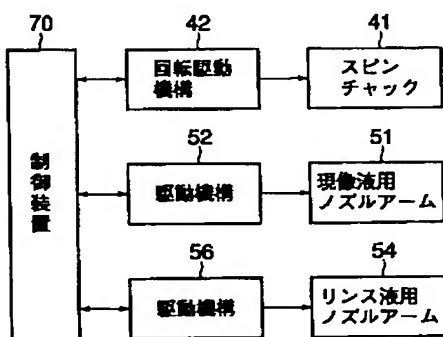
[Drawing 2]



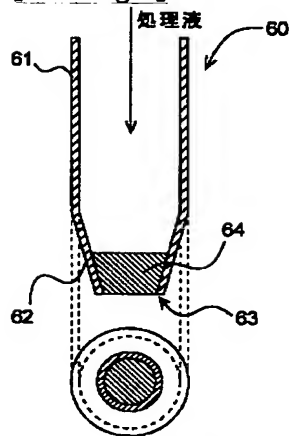
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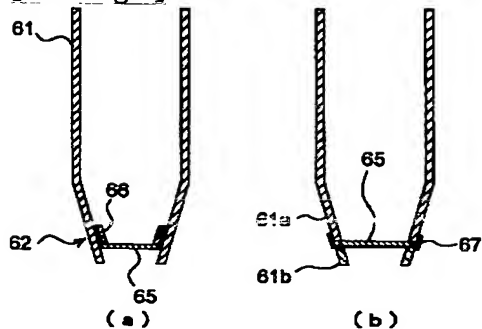
[Drawing 4]



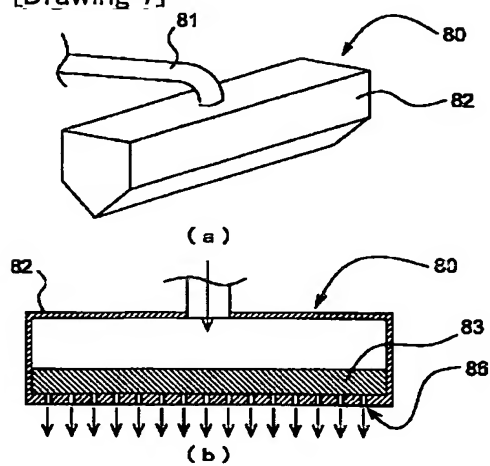
[Drawing 5]



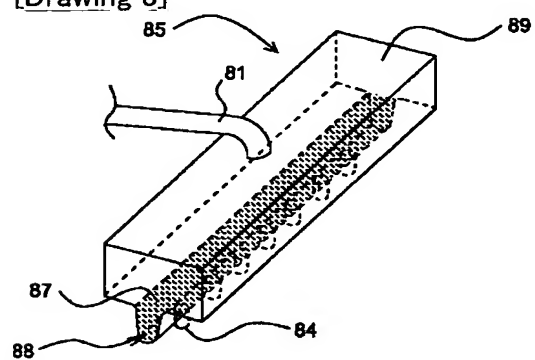
[Drawing 6]



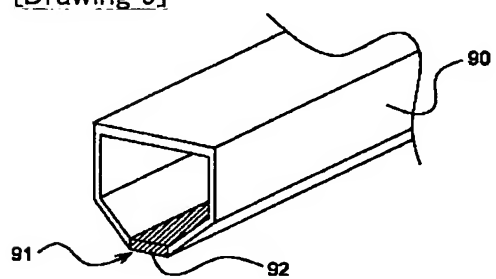
[Drawing 7]



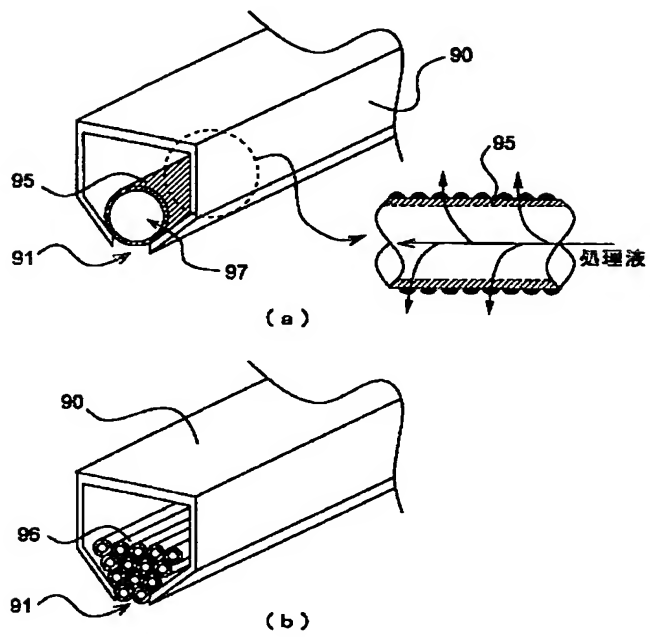
[Drawing 8]



[Drawing 9]



[Drawing 10]



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[Translation done.]

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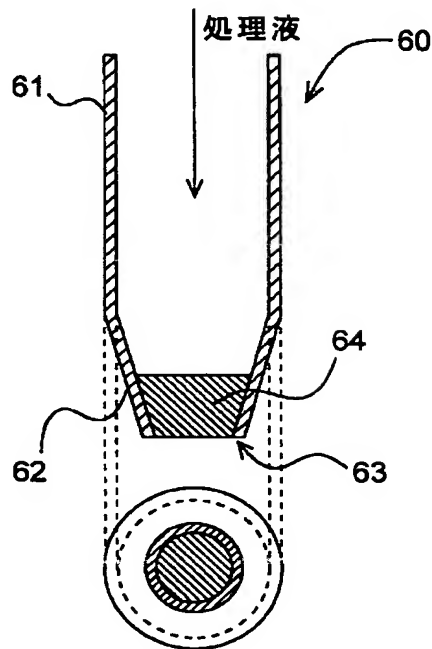
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(54) 【発明の名称】 処理液吐出ノズルおよび液処理装置

(57) 【要約】

【課題】 例えば、液晶ディスプレイ (LCD) 用ガラス基板や半導体ウェハのような基板の液処理に用いられる、液垂れを防止した処理液吐出ノズルおよびこれを用いた液処理装置を提供する。

【解決手段】 処理液吐出ノズルの1つであるリンス液吐出ノズル60は、処理液を送る送液管61と送液管61に連通され、処理液を吐出する吐出部62とを有する。吐出部62に液保持力を有する多孔質体64を配設して、液垂れを防止した。



## 【特許請求の範囲】

【請求項 1】 処理液を被処理体に吐出する処理液吐出ノズルであって、  
処理液を送る送液管と、  
前記送液管に連通され、処理液を吐出する吐出部とを有し、  
前記吐出部に、液保持力を有する多孔質体が配設されていることを特徴とする処理液吐出ノズル。

【請求項 2】 処理液を被処理体に吐出する処理液吐出ノズルであって、  
処理液を送る送液管と、  
前記送液管に連通され、下部に処理液を吐出する吐出部が形成され、略水平方向に配置されるノズルブロックとを備え、  
液保持力を有する多孔質体が、前記ノズルブロックにその長さ方向に略平行に配設されていることを特徴とする処理液吐出ノズル。

【請求項 3】 前記多孔質体が、前記吐出部に近接して配設されていることを特徴とする請求項 2 に記載の処理液吐出ノズル。

【請求項 4】 前記多孔質体が中空糸または中空糸束であることを特徴とする請求項 1 から請求項 3 のいずれか 1 項に記載の処理液吐出ノズル。

【請求項 5】 前記処理液が、前記中空糸または中空糸束に形成されている空洞部へ供給され、前記中空糸または中空糸束の外部へ前記処理液が濾過されて排出されることを特徴とする請求項 4 に記載の処理液吐出ノズル。

【請求項 6】 前記多孔質体が、中空糸膜、メンブレンフィルタ、セラミックフィルタのいずれかであることを特徴とする請求項 1 から請求項 3 のいずれか 1 項に記載の処理液吐出ノズル。

【請求項 7】 基板を保持する保持部と、基板の表面に処理液を吐出する処理液吐出ノズルと、前記処理液吐出ノズルを待機位置から基板の上方へ移動させる処理液吐出ノズル移動機構とを具備する液処理装置であって、  
前記処理液吐出ノズルは、処理液を送る送液管と、当該送液管に連通され、処理液を吐出する吐出部とを有し、  
前記吐出部に、液保持力を有する多孔質体が配設されていることを特徴とする液処理装置。

【請求項 8】 基板を保持する保持部と、基板の表面に処理液を吐出する処理液吐出ノズルと、前記処理液吐出ノズルを待機位置から基板の上方へ移動させる処理液吐出ノズル移動機構とを具備する液処理装置であって、  
前記処理液吐出ノズルは、  
処理液を送る送液管と、  
前記送液管に連通され、下部に処理液を吐出する吐出部が形成され、略水平方向に配置されるノズルブロックとを備え、  
液保持力を有する多孔質体が、前記ノズルブロックにその長さ方向に略平行に配設されていることを特徴とする

液処理装置。

【請求項 9】 前記多孔質体が中空糸または中空糸束であることを特徴とする請求項 7 または請求項 8 に記載の液処理装置。

【請求項 10】 前記処理液が、前記中空糸または中空糸束に形成されている空洞部へ供給され、前記中空糸または中空糸束の外部へ前記処理液が濾過されて排出されることを特徴とする請求項 9 に記載の液処理装置。

【請求項 11】 前記多孔体が、中空糸膜、メンブレンフィルタ、セラミックフィルタのいずれかであることを特徴とする請求項 7 または請求項 8 に記載の液処理装置。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、例えば液晶ディスプレイ（LCD）用ガラス基板や半導体ウエハのような基板に液処理を行う処理液吐出ノズルおよび液処理装置に関する。

【0002】

【従来の技術】例えば、液晶ディスプレイ（LCD）の製造においては、ガラス製の矩形の LCD 基板にフォトリソグロフ技術により所定の回路パターンが形成される。

【0003】このような回路パターンの形成は、複数の処理ユニットが集約されたレジスト塗布・現像システムを用いて行われる。このようなシステムにおいては、まず、基板に対して必要に応じて紫外線照射により表面改質・洗浄処理が行われた後、洗浄ユニットによりブラシ洗浄および超音波水洗浄が施される。その後、基板は、レジストの安定性を高めるために、アドヒージョン処理ユニットにて疎水化処理（HMDS 処理）され、引き続き、レジスト塗布ユニットにてレジスト塗布が行われ、ブリベーク後、露光装置にて所定の回路パターンが露光され、さらに現像処理ユニットで現像処理され、ポストベーク処理されて所定の回路パターンが形成される。

【0004】ここで、現像処理ユニットについてさらに詳しく説明すると、現像処理ユニットは、基板に現像液を吐出する現像液吐出ノズルと、現像処理後にリンス液を吐出するリンス液吐出ノズルと、基板保持用のスピンチャックと、現像液吐出ノズルとリンス液吐出ノズルをそれぞれ待機位置から基板上に移動させる移動機構と、スピンチャック周囲に振り切った処理液（現像液、リンス液）を回収するカップを備えている。

【0005】この現像処理ユニットにて現像処理する際には、まず、スピンチャック上に基板を載置し、現像液吐出ノズルを待機位置から基板上に移動させて現像液を基板上に液盛りする。液盛り終了後、現像液吐出ノズルは待機位置へ移動する。この状態で所定の現像時間保持

した後スピンチャックを回転させ、現像液を振り切り、次いでリンス液吐出ノズルを待機位置から基板上に移動させ、スピンチャックを回転させながらリンス液を吐出し、その後、リンス液の供給を停止してリンス液の振り切り乾燥を行う。振り切り乾燥後にリンス液吐出ノズルが待機位置に移動する。

【0006】

【発明が解決しようとする課題】上述したように、洗浄水、現像液、レジスト、レジスト塗布の前後で用いられるシンナー等の種々の処理液は、ノズルから吐出されるが、従来は、吐出後にノズルの吐出口近傍に液溜まりが生じ、この液溜まりの液垂れによって、製品が汚染される場合があった。

【0007】例えば、レジスト塗布を行うレジスト吐出ノズルからレジスト液の液垂れが発生した場合には、極端的にレジスト膜の厚みが異なる部分が生じたり、また、塗布むらが生ずる等の問題が発生し、結果的に不良品の発生を招く。そして、この問題を回避するために、サックバック機能を取り付ける等した場合には、ノズルの構造が複雑となり、また、レジスト吐出ノズル自体の製造コストが高くなる等の問題を生ずる。

【0008】現像処理においても、現像液吐出ノズルを格納する途中で、所定の現像液吐出位置から外れた部分に現像液が垂れ落ちた場合には、部分的に現像精度が異なる場合があり、品質の低下を招く。

【0009】リンス工程においては、振り切り乾燥が終わってリンス液吐出ノズルが待機位置に移動する際に、基板上にリンス液がリンス液吐出ノズルから液垂れするおそれがある。リンス液の液垂れが起こった場合には、基板上に跡が付いたり、垂れ落ちたリンス液が基板搬送装置に付着して、他の基板にリンス液が付着する可能性が大きくなる。このようにして、基板上にリンス液跡がついたり、他基板に付着等すると、製品の歩留まりが低下するという問題を生ずる。

【0010】本発明はかかる事情に鑑みてなされたものであって、各種処理液の吐出ノズルについて、構造を複雑化させることなく、また、移動時に処理液が基板上に液垂れすることを防止した処理液吐出ノズルおよびこのような処理液吐出ノズルを備えた液処理装置を提供することを目的とする。

【0011】

【課題を解決するための手段】上記課題を解決するために、本発明によれば、第1の処理液吐出ノズルとして、処理液を被処理体に吐出する処理液吐出ノズルであって、処理液を送る送液管と、前記送液管に連通され、処理液を吐出する吐出部とを有し、前記吐出部に、液保持力を有する多孔質体が配設されていることを特徴とする処理液吐出ノズル、が提供される。

【0012】また、本発明によれば、第2の処理液吐出ノズルとして、処理液を被処理体に吐出する処理液吐出

ノズルであって、処理液を送る送液管と、前記送液管に連通され、下部に処理液を吐出する吐出部が形成され、略水平方向に配置されるノズルブロックとを備え、液保持力を有する多孔質体が、前記ノズルブロックにその長さ方向に略平行に配設されていることを特徴とする処理液吐出ノズル、が提供される。この第2の処理液吐出ノズルについては、多孔質体は吐出部に近接して配設することが好ましい。

【0013】上述した第1・第2の処理液吐出ノズルにおいては、所定量の処理液の吐出後に、吐出部に残留する処理液は、適所に配設された多孔質体の有する毛細管現象等を用いた吸引力によって、液垂れすることなく吐出部に保持される。これにより、ノズルからの液垂れの発生が防止されて、生産歩留まりの向上が図られる。

【0014】これら第1・第2の処理液吐出ノズルにおいて、多孔質体としては、中空糸または中空糸束が好適に用いられ、これらの材料を用いた場合には、処理液が中空糸または中空糸束に形成されている空洞部へ供給され、中空糸または中空糸束の外部へ処理液が濾過されて排出され、さらに吐出部から吐出される構成とすることが好ましい。これにより、多孔質体による液保持に加えて、多孔質体がフィルタとしても機能して、処理液中の不要な固形物等を除去することが可能となる。

【0015】その他の多孔質体としては、例えば、中空糸膜、メンブレンフィルタ、セラミックフィルタを挙げることができる。いずれの材料も、液保持力を有するように、その気孔径が小さいことが好ましく、このような材料によっても、処理液が濾過されることとなり、基板等の被処理体へのパーティクル等の付着を防止することができる。

【0016】さて、本発明によれば、上述した第1・第2の処理液吐出ノズルを有する液処理装置もまた、提供される。すなわち、基板を保持する保持部と、基板の表面に処理液を吐出する処理液吐出ノズルと、前記処理液吐出ノズルを待機位置から基板の上方へ移動させる処理液吐出ノズル移動機構とを具備する液処理装置であって、前記処理液吐出ノズルは、処理液を送る送液管と、当該送液管に連通され、処理液を吐出する吐出部とを有し、前記吐出部に、液保持力を有する多孔質体が配設されていることを特徴とする液処理装置、が提供される。

【0017】また、基板を保持する保持部と、基板の表面に処理液を吐出する処理液吐出ノズルと、前記処理液吐出ノズルを待機位置から基板の上方へ移動させる処理液吐出ノズル移動機構とを具備する液処理装置であって、前記処理液吐出ノズルは、処理液を送る送液管と、前記送液管に連通され、下部に処理液を吐出する吐出部が形成され、略水平方向に配置されるノズルブロックとを備え、液保持力を有する多孔質体が、前記ノズルブロックにその長さ方向に略平行に配設されていることを特徴とする液処理装置、が提供される。これらの液処理装



置における処理液吐出ノズルには、上述した第1・第2の処理液吐出ノズルの各種形態を適用することができ、これにより、処理効率に優れる液処理装置が提供される。

【0018】

【発明の実施の形態】以下、添付図面を参照して、本発明の実施の形態について詳細に説明する。図1は、本発明の処理液吐出ノズルおよびこの処理液吐出ノズルを用いた液処理装置が好適に適用されるLCD基板（以下、「基板」と記す。）のレジスト塗布・現像処理システム（以下、「処理システム」と記す。）を示す平面図であり、まず、この処理システムについて概説することとする。

【0019】この処理システムは、複数の基板Gを収容するカセットCを載置するカセットステーション1と、基板Gにレジスト塗布および現像を含む一連の処理を施すための複数の処理ユニットを備えた処理部2と、露光装置（図示せず。）との間で基板Gの受け渡しを行うためのインターフェイス部3とを備えており、処理部2の両端にそれぞれカセットステーション1およびインターフェイス部3が配置されている。

【0020】カセットステーション1は、カセットCと処理部2との間で基板Gの搬送を行うための搬送機構10を備えている。そして、カセットステーション1においてカセットCの搬入出が行われる。また、搬送機構10はカセットの配列方向に沿って設けられた搬送路10a上を移動可能な搬送アーム11を備え、この搬送アーム11によりカセットCと処理部2との間で基板Gの搬送が行われる。

【0021】処理部2は、前段部2aと中段部2bと後段部2cとに分かれており、それぞれ中央に搬送路12・13・14を有し、これら搬送路の両側に各処理ユニットが配設されている。そして、これらの間には中継部15・16が設けられている。

【0022】前段部2aは、搬送路12に沿って移動可能な主搬送装置17を備えており、搬送路12の一方側には、2つの洗浄ユニット（SCR）21a・21bが配置されており、搬送路12の他方側には紫外線照射ユニット（UV）と冷却ユニット（COL）とが2段に重ねられた処理ブロック25、加熱処理ユニット（HP）が2段に重ねられてなる処理ブロック26および冷却ユニット（COL）が2段に重ねられてなる処理ブロック27が配置されている。

【0023】また、中段部2bは、搬送路13に沿って移動可能な主搬送装置18を備えており、搬送路13の一方側には、レジスト塗布処理ユニット（CT）22および基板Gの周縁部のレジストを除去する周縁レジスト除去ユニット（ER）23が一体的に設けられており、搬送路13の他方側には、加熱処理ユニット（HP）が2段に重ねられてなる処理ブロック28、加熱処理ユニ

ット（HP）と冷却処理ユニット（COL）が上下に重ねられてなる処理ブロック29、およびアドヒージョン処理ユニット（AD）と冷却ユニット（COL）とが上下に重ねられてなる処理ブロック30が配置されている。

【0024】さらに、後段部2cは、搬送路14に沿って移動可能な主搬送装置19を備えており、搬送路14の一方側には、3つの現像処理ユニット（DEV）24a・24b・24cが配置されており、搬送路14の他方側には加熱処理ユニット（HP）が2段に重ねられてなる処理ブロック31、およびともに加熱処理ユニット（HP）と冷却処理ユニット（COL）が上下に重ねられてなる処理ブロック32・33が配置されている。

【0025】なお、処理部2は、搬送路を挟んで一方の側に洗浄処理ユニット21a、レジスト処理ユニット22、現像処理ユニット24aのようなスピナー系ユニットのみを配置しており、他方の側に加熱処理ユニットや冷却処理ユニット等の熱系処理ユニットのみを配置する構造となっている。

【0026】また、中継部15・16のスピナー系ユニット配置側の部分には、薬液供給ユニット34が配置されており、さらに主搬送装置のメンテナンスを行うためのスペース35が設けられている。

【0027】主搬送装置17・18・19は、それぞれ水平面内の2方向のX軸駆動機構、Y軸駆動機構、および垂直方向のZ軸駆動機構を備えており、さらにZ軸を中心に回転する回転駆動機構を備えており、それぞれ基板Gを支持するアーム（図示せず。）を有している。

【0028】主搬送装置17は、搬送機構10のアーム11との間で基板Gの受け渡しを行うとともに、前段部2aの各処理ユニットに対する基板Gの搬入・搬出、さらには中継部15との間で基板Gの受け渡しを行う機能を有している。また、主搬送装置18は中継部15との間で基板Gの受け渡しを行うとともに、中段部2bの各処理ユニットに対する基板Gの搬入・搬出、さらには中継部16との間の基板Gの受け渡しを行う機能を有している。さらに、主搬送装置19は中継部16との間で基板Gの受け渡しを行うとともに、後段部2cの各処理ユニットに対する基板Gの搬入・搬出、さらにはインターフェイス部3との間の基板Gの受け渡しを行う機能を有している。なお、中継部15・16は冷却プレートとしても機能する。

【0029】インターフェイス部3は、処理部2との間で基板を受け渡しする際に一時的に基板を保持するエクステンション36と、さらにその両側に設けられた、バッファカセットを配置する2つのバッファステージ37と、これらと露光装置（図示せず。）との間の基板Gの搬入出を行う搬送機構38とを備えている。搬送機構38はエクステンション36およびバッファステージ37の配列方向に沿って設けられた搬送路38a上を移動

可能な搬送アーム39を備え、この搬送アーム39により処理部2と露光装置との間で基板Gの搬送が行われる。

【0030】このように各処理ユニットを集約して一体化することにより、省スペース化および処理の効率化を図ることができる。

【0031】このように構成された処理システムにおいては、カセットC内の基板Gが、処理部2に搬送され、処理部2では、まず、前段部2aの処理ブロック25の紫外線照射ユニット(UV)で表面改質・洗浄処理が行われ、冷却処理ユニット(COL)で冷却された後、洗浄ユニット(SCR)21a・21bでスクラパー洗浄が施され、処理ブロック26のいずれかの加熱処理ユニット(HP)で加熱乾燥された後、処理ブロック27のいずれかの冷却ユニット(COL)で冷却される。

【0032】その後、基板Gは中段部2bに搬送され、レジストの定着性を高めるために、処理ブロック30の上段のアドヒージョン処理ユニット(AD)にて疎水化処理(HMDS処理)され、下段の冷却処理ユニット(COL)で冷却後、レジスト塗布処理ユニット(C2)22でレジストが塗布され、周縁レジスト除去ユニット(ER)23で基板Gの周縁の余分なレジストが除去される。その後、基板Gは、中段部2bの中の加熱処理ユニット(HP)の1つでプリベーク処理され、処理ブロック29または30の下段の冷却ユニット(COL)で冷却される。

【0033】その後、基板Gは中継部16から主搬送装置19にてインターフェイス部3を介して露光装置に搬送されてそこで所定のパターンが露光される。そして、基板Gは再びインターフェイス部3を介して搬入され、必要に応じて後段部2cの処理ブロック31・32・33のいずれかの加熱処理ユニット(HP)でポストエクスポージャーベーク処理を施した後、現像処理ユニット(DEV)24a・24b・24cのいずれかで現像処理され、所定の回路パターンが形成される。現像処理された基板Gは、後段部2cのいずれかの加熱処理ユニット(HP)にてポストベーク処理が施された後、いずれかの冷却ユニット(COL)にて冷却され、主搬送装置19・18・17および搬送機構10によってカセットステーション1上の所定のカセットに収容される。

【0034】本発明は、上述した処理システムにおいて用いられる種々の処理液、例えば、基板洗浄水(純水)、レジスト、現像液、リンス液等の吐出に関して用いられるが、以下、現像ユニット(DEV)を例に、本発明を説明することとする。

【0035】図2は現像処理ユニット(DEV)の断面図であり、図3は現像処理ユニット(DEV)の平面図である。図2に示すように、現像処理ユニット(DEV)24a・24b・24cにおいては、基板Gを機械的に保持する、例えば、スピンチャック41が回転駆動

機構42により回転されるように設けられ、このスピンチャック41の下側には、回転駆動機構42を包囲するカバー43が配置され、このカバー43の外周囲には、2つのアンダーカップ44・45が離間して設けられている。

【0036】この2つのアンダーカップ44・45の間の上方には、主として現像液を下方に流すためのインナーカップ46が昇降自在に設けられ、アンダーカップ45の外側には、主としてリンス液を下方に流すためのアウトターカップ47がインナーカップ46と一体的に昇降自在に設けられている。図2において、左側には、現像液の排出時に、インナーカップ46およびアウトターカップ47が上昇される位置が示され、右側には、リンス液の排出時に、これらが降下される位置が示されている。

【0037】さらに、これら現像処理ユニット全体を包囲するためのシンク48が設けられ、シンク48には、回転乾燥時にユニット内を排気するための排気口49、現像液のためのドレイン管50a、およびリンス液のためのドレイン管50bが設けられている。

【0038】図3に示すように、アウトターカップ47の一方の側には、現像液用のノズルアーム51が設けられ、ノズルアーム51内には現像液吐出ノズル80が収納されている。ノズルアーム51は、ガイドレール53に沿って、ベルト駆動等の駆動機構52により基板Gを横切って軌道するように構成され、これにより、現像液の塗布時には、ノズルアーム51は、現像液供給ノズルから現像液を吐出しながら、静止した基板Gをスキャンするようになっている。

【0039】アウトターカップ47の他方の側には、純水等のリンス液用のノズルアーム54が設けられ、ノズルアーム54の先端部分には、リンス液吐出ノズル60が設けられている。ノズルアーム54は、枢軸55を中心として駆動機構56により回転自在に設けられている。これにより、リンス液の吐出時には、ノズルアーム54は、リンス液吐出ノズル60からリンス液を吐出しながら、基板G上をスキャンするようになっている。

【0040】なお、アウトターカップ47の上方には、昇降自在に蓋体(図示せず。)が設けられており、リンスの際にこの蓋体が閉じられるようになっている。また、リンス液吐出ノズル60をカップ内に入れたまま蓋体を閉じることができるように、アウトターカップ47には切り欠きが形成されている。

【0041】また、図4に示すように、スピンチャック41を回転させる回転駆動機構42、現像液用のノズルアーム51を駆動する駆動機構52、およびリンス液用のノズルアーム54を回動させる駆動機構56は、いずれも制御装置70により制御されるようになっている。

【0042】次に、上述した現像処理ユニット(DEV)24a・24b・24cに用いられているリンス液吐出ノズル60に、本発明を適用した一実施形態を図5

の断面図および正面図に示す。図 5 に示されるリンス液吐出ノズル 60 は、直管状の送液管 61 の先端部に、その外径を徐々に絞った吐出部 62 が形成された構造を有しており、吐出部 62 には、液保持力を有する多孔質体 64 が配設されている。

【0043】吐出部 62 の開口部に当たる吐出口 63 の内径は、送液管 61 の内径と同じかそれ以上であっても構わないが、図 5 に示すように、吐出口 63 の径を送液管 61 の内径より小さく絞ることによって、多孔質体 64 はリンス液（処理液）の吐出時に吐出部 62 における内壁によって落下が防止され、また、他の固定方法を用いる必要がない点で好ましい。

【0044】また、図 5 では、多孔質体 64 は円錐台形のものが用いられているが、膜状のもので用いることもできる。例えば、図 6 (a) に示すように、吐出部 62 の内側に金具 66 を配して、金具 66 と送液管 61 の内壁との間で膜状体 65 を固定する方法や、図 6 (b) に示すように、吐出部 62 において、送液管 61 を胴体部 61a と先端部 61b とに長さ方向に分割できるように構成し、連結金具 67 を用いた結合の際に、膜状体 65 を胴体部 61a と先端部 61b との間に挟み込んで固定する方法等を用いることができる。

【0045】多孔質体 64 としては、液保持力を有するもの、つまり、送液を停止して送液圧力がかからない状態で保液能力の高いものが用いられる。例えば、中空糸、中空糸束、中空糸膜、メンブレンフィルタ、セラミックフィルタ等の毛細管現象により液を吸収して保持する能力を有するものが挙げられる。その材質は、リンス液等、処理液に侵されない限りにおいて制限はない。リンス液吐出ノズル 60 では、その形状から、中空糸膜、メンブレンフィルタ、セラミックフィルタを用いると配設が容易である。いずれの材料を用いた場合でも、リンス液の吐出に大型ポンプ等を用いる等の設備負担を強いられることのない範囲で、より大きな液保持力を有するように、気孔径の小さいものを用いたり、あるいは配設する材料の厚みを制御すればよい。

【0046】リンス液吐出ノズル 60 の吐出部 62 に多孔質体 64 を配設すると、リンス液が送液管 61 の図上側からポンプやガス圧等を利用して送られ、吐出口 63 から吐出されたときに、吐出口 63 近傍に液溜まりが形成されても、多孔質体 64 によってリンス液が保持され、液垂れが回避されることとなる。また、多孔質体 64 の液保持力が大きい場合には、リンス液吐出ノズル 60 を移動する際に液溜まりに力が掛かっても、その落下を防止することができる。さらに、リンス液吐出ノズル 60 には、サックバック機構等の複雑な液垂れ防止機構を取り付ける必要がなく、その結果、構造が簡単で安価に作製できる利点もある。

【0047】多孔質体 64 はフィルタとしても機能することから、リンス液中の固体不純物を除去する機能をも

有し、基板へのパーティクル、ゴミ等の付着を防止する役割をも果たす。多孔質体 64 がリンス液中に含まれる固体不純物によって目詰まりを起しても、送液管 61 または吐出部 62 を取り外し可能な構造としておけば、多孔質体 64 をはじめ各種部品の交換や洗浄も容易であり、製品品質を考慮すれば、装置のランニングコストは高いものとはならない。

【0048】なお、多孔質体 64 は、内包する多数の連通気孔が吐出口として機能することから、多孔質体 64 から均一にリンス液を吐出する機能をも有するが、このような均一吐出を目的として、液保持力を有しないか、または液保持力が小さい多孔質体を配設した形態は、本発明の範疇に含まれない。

【0049】次に、本発明を現像液吐出ノズル 80 に適用した一実施形態について、図 7 (a) に示した斜視図および図 7 (b) に示した断面図を参照しながら説明する。現像液吐出ノズル 80 は、現像液を送る送液管 81 と、送液管 81 に連通されたノズルブロック 82 で構成されている。ノズルブロック 82 は一方に長い空洞を有する形状となっており、この空洞内に処理液（現像液）が供給される。なお、送液管 81 はエアオペレーションバルブ（図示せず。）につながっており、現像液の供給・停止を制御することが可能である。

【0050】ノズルブロック 82 の下部には、現像液を吐出する吐出部 86 が、ノズルブロック 82 の長さ方向に複数ほど所定間隔で形成されており、現像液は各吐出部 86 から吐出される。従って、ノズルブロック 82 を、その長さ方向に垂直な方向へ水平に移動させながら現像液を吐出した場合には、広範囲に均一に現像液が吐出され、基板 G 上に現像液が液盛りされる。

【0051】吐出部 86 のそれぞれについて、先に図 5 に示したように、その吐出口（吐出部 86 の下部開口部を指す。）付近に多孔質体を配設することが可能であるが、現像液吐出ノズル 80 では、ノズルブロック 82 の空洞下部に多孔質体 83 が配設されている。これにより、処理液は多孔質体 83 を通過する際に多孔質体 83 によって濾過された後に、吐出部 86 から吐出される。

【0052】現像液吐出ノズル 80 では、多孔質体 83 が吐出部 86 に近接して配設されていることから、吐出部 86 に液溜まりが形成されても、多孔質体 83 の液保持力によって液垂れが防止される。また、現像液は多孔質体 83 によって濾過されることから、現像液中の固形不純物が除去され、被処理体（基板）へのパーティクル等の付着が防止される。一方、ノズルブロック 82 を開閉可能な構造としておけば、多孔質体 83 が目詰まりを起した場合であっても、交換が容易である。

【0053】さらに、現像液は、多孔質体 83 に濾過される際の圧損により、多孔質体 83 全体からほぼ均一な圧力で吐出されるために、現像液の吐出を各吐出部 86 から均一に行う役割をも果たす。これにより、基板処理

を全体的に均一に行うことができるようになる。つまり、多孔質体 83 が配設されていない場合には、送液管 81 に近い吐出部からより多くの現像液が吐出し易く、その結果、現像処理にむらを生じやすいが、多孔質体 83 の配設によりこのような問題が回避される。多孔質体 83 としては、前述した各種の材料を用いることができる。

【0054】図 8 は、図 7 に示されている現像液吐出ノズル 80 に代えて用いることができる別の現像液吐出ノズル 85 の形態を示す説明図であり、現像液吐出ノズル 85 に用いられているノズルブロック 89 の下部には、幅が狭められた溝部 88 が形成され、複数の吐出部 84 がこの溝部 88 から下方に突出する形で形成されている。多孔質体 87 の配設は、溝部 88 に充填されるように、または吐出部 84 に充填もしくは吐出部 84 の吐出口を覆うようにして行うことができ、前述したノズルブロック 80 と同様に使用することができる。

【0055】図 9 は、図 7 中に示されているノズルブロック 82 に代えて用いることができるさらに別のノズルブロックの形態を示す説明図であり、このノズルブロック 90 では、下部にスリット状の吐出部 91 が形成されており、吐出部 91 の吐出口を塞ぐように多孔質体 92 が配設されている。このような構成は、前述した現像液吐出ノズル 80・85 の吐出部を連続的に形成したものと考えることができ、現像液吐出ノズル 80・85 と同様に用いることができ、また、同等の効果を奏する。

【0056】図 7～図 9 に示されているノズルブロック 82・89・90 は、一方向に長い形状を有しており、また、その下部が溝形に形成され、または幅が狭められた形状となっていることから、液保持力の大きい中空糸や中空糸束を、ノズルブロック 82・89・90 の長さ方向に沿うようにして、所定深さほど充填して配設することが容易である。

【0057】図 10 (a)、(b) は、ノズルブロック 90 を用い、その内部に中空糸 95 および中空糸束 96 を配設した形態を示した説明図である。このような形態とした場合には、現像液を中空糸 95 または中空糸束 96 に形成されている空洞部 97 へ供給し、中空糸 95 または中空糸束 96 の外部へ現像液が濾過されて排出され、さらに各吐出部から吐出される構成とすることが容易に可能である。この場合には、中空糸 95 または中空糸束 96 の有する液保持力および濾過能力を十分に活かして、処理性能の向上を図ることが可能となる。

【0058】なお、図 10 の形態においては、現像液を、中空糸 95 または中空糸束 96 が配設されていないノズルブロック 90 の内部空洞の上部空間に供給し、中空糸 95 または中空糸束 96 の外部から内部空洞を経て、または中空糸 95 または中空糸束 96 の壁面を通して、再び外部に排出されるように、フィルタとして用い、吐出部 91 より吐出する方法を用いることもでき

る。

【0059】以上、本発明の実施の形態について説明してきたが、本発明は上記実施の形態に限定されるものではない。例えば、上記実施形態ではレジスト塗布・現像処理システムに本発明の処理液吐出ノズルおよびこれを用いた液処理装置を適用した場合について説明したが、これに限るものではない。また、被処理基板として LCD 基板について説明してきたが、半導体ウエハ、CD 基板等の他の基板についても用いることが可能である。

【0060】

【発明の効果】上述の通り、本発明によれば、処理液を吐出する各種のノズルの吐出部近傍に液保持力を有する多孔質体が配設されていることから、吐出終了後に、吐出口に液溜まりが形成された場合であっても、多孔質体によって液が吸引されて、液垂れが防止される。これにより、処理基板や基板を移動等させる機構部材が汚染されることなく、歩留まりの向上が図られるという顕著な効果を奏する。また、液垂れの防止という観点からは、サックバック機能等の複雑な機構を取り付ける必要がなく、構造や形状の設計自由度が大きくなり、また、製造コストも抑えることが可能となる利点もある。さらに、本発明によれば、多孔質体は処理液の濾過機能をも有することから、処理液中の各種固形不純物が除去される。これにより、処理基板へのパーティクル等の付着が防止され、製品（処理基板）の品質の向上や歩留まりの向上が図られる。加えて、多孔質体を配設することにより、処理液が多孔質体から均一に吐出されることから、液処理の均質性の向上、ひいては製品の品質向上が図られる等、本発明は種々の効果を奏する。

【図面の簡単な説明】

【図 1】本発明の対象となる加熱処理装置が適用されるレジスト塗布・現像システムを示す平面図。

【図 2】現像処理ユニット (DEV) の断面図。

【図 3】現像処理ユニット (DEV) の平面図。

【図 4】図 2 および図 3 に示した現像処理ユニットにおける制御系を示すブロック図。

【図 5】本発明を適用した処理液吐出ノズル（リンス液吐出ノズル）の一実施形態を示す断面図および正面図。

【図 6】図 5 記載の処理液吐出ノズルにおける多孔質体の別の配設形態を示す断面図。

【図 7】本発明を適用した処理液吐出ノズル（現像液吐出ノズル）の別の実施形態を示す斜視図および断面図。

【図 8】本発明を適用した処理液吐出ノズル（現像液吐出ノズル）のさらに別の実施形態を示す斜視図。

【図 9】本発明を適用した処理液吐出ノズル（現像液吐出ノズル）に用いられるノズルブロックの別の実施形態を示す説明図。

【図 10】本発明を適用した処理液吐出ノズル（現像液吐出ノズル）に用いられるノズルブロックのさらに別の実施形態を示す説明図。

## 【符号の説明】

24 a、24 b、24 c；現像処理ユニット

41；スピンチャック

42；回転駆動機構

46；インナーカップ

47；アウターカップ

60；リンス液吐出ノズル（処理液吐出ノズル）

61；送液管

62；吐出部

63；吐出口

\* 64；多孔質体

80、85；現像液吐出ノズル

81；送液管

82、89、90；ノズルブロック

83、87、92；多孔質体

86；吐出部

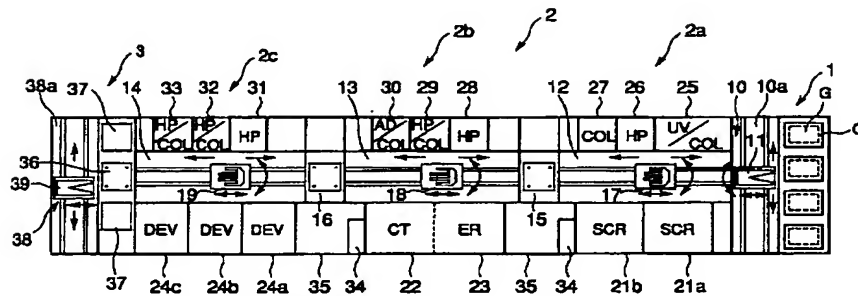
88；溝部

95；中空糸

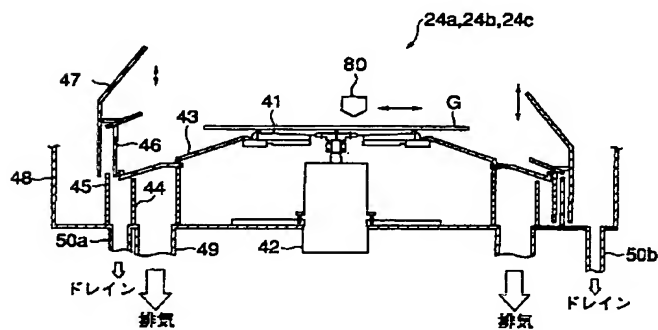
96；中空糸束

\* 10

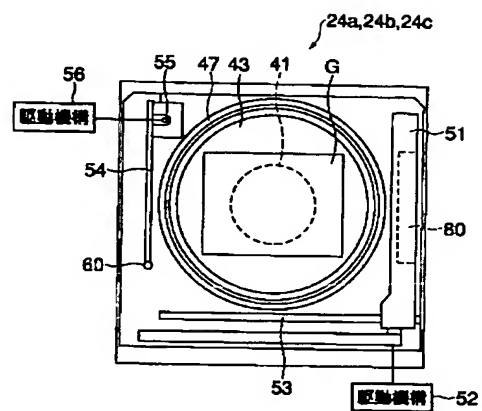
【図1】



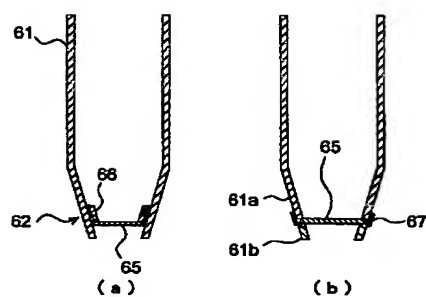
【図2】



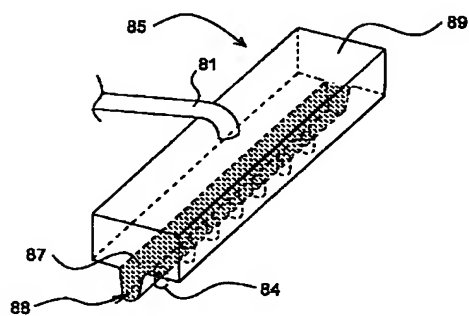
【図3】



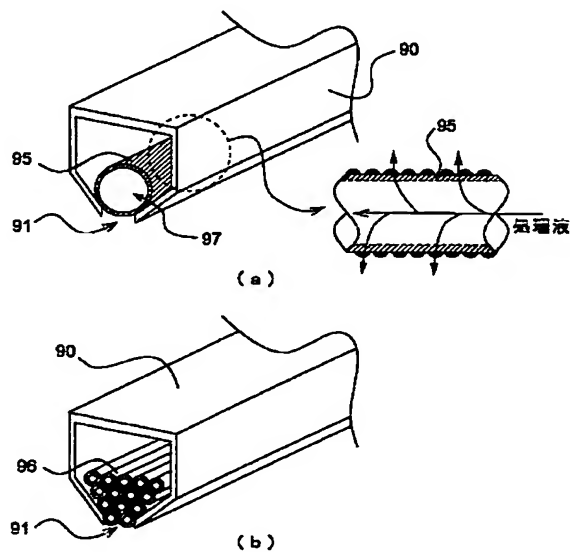
【图6】



【图8】



【図10】



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